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ABSTRACT

This study was undertaken to test the effectiveness of a computer-assisted tutorial (CAI) program in teaching the novice and transient user the procedures for conducting a search on The New York Times Information Bank. A two-part experiment was designed to compare the relative effectiveness of the CAI program and the printed instructions accompanying the system. Sixty-four volunteers participated. Results indicated that the computer-assisted tutorial program is a more effective training tool than the printed instructions offered by the system. The rate of success in completing a meaningful search on The New York Times Information Bank without any human assistance was 47% for those exposed to the 30 minute CAI session and dropped to 8% for those who had access to printed instructions alone. Shortcomings of both methods of instruction are discussed and a detailed analysis of user reactions to The New York Times Information Bank on-line instructional messages is provided. (Author/DAG)

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THE NEW YORK TIMES INFORMATION BANK IN AN ACADEMIC ENVIRONMENT AND A COMPUTER-ASSISTED TUTORIAL FOR ITS NON-SPECIALIST USERS

Dineh Moghdam, Ph.D.

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Based upon a feasibility study involving thirty five participants from the Graduate School of Library and Information Sciences, University of Pittsburgh, a two-part experiment was designed to compare the relative effectiveness of the CAI program and the printed instructions accompanying the system. Sixty four volunteers from the entire academic community participated in this experiment.

The quantitative as well as the qualitative analysis of data clearly support the hypothesis that the computer-assisted tutorial program for The New York Times Information Bank is a more effective training tool than the printed instructions offered by the system. What is also clearly shown by the data is that the tutorial program, though more effective than the printed instructions, is far from being a fully effective training medium. The rate of success in completing a meaningful search on The New York Times Information

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Bank without any human assistance was 47% for those who were exposed to the 30-minute CAI session and dropped to 8% for those who had access to printed instructions alone. Shortcomings of both methods of instruction are discussed. The author agrees with the majority of systems designers that, in its present stage of development, on-line information retrieval systems must offer live help to complement other forms of instruction.

The qualitative findings of the first-time user/system encounter were analyzed to determine the more subtle reasons for search failure. A detailed analysis of user reactions to The New York Times Information Bank on-line instructional messages is provided and recommendations based upon these findings are limited to the bounds of the physical capacity of the present system structure.

CHAPTER I

INTRODUCTION

> The New York Times Information Bank is an on-line, interactive information retrieval system. It has been under active development since mid-1966, although it was thought about and talked about for several years prior to that. In another sense, the origins of The Information Bank go back to 1851. That was the year that the New York Times began publishing a newspaper and simultaneously began compiling an index. (1)

The Information Bank, designed through the joint effort of IBM and The New York Times, became fully operational in February of 1973. It provides virtually full coverage of all news articles and features from The New York Times as well as selective access to material from about sixty other newspapers and periodicals. As of October 1974 there are over 800,000 citations and 400,000 index terms stored in the data base which extends back to January 1969. (2) The processing goal for current material is within four working days after publication of the final Late City Edition of The New York Times. The estimated input per year under normal circumstances is considered to be "about 100,000 Times articles and 150,000 non-Times articles." (3)

All indexing and abstracting is done by subject-specialists from clippings assigned to them by a senior editor. The full text of these clippings are microfiched and made available to system users as a back up file for the Information Bank. However, no full text is provided for the non-Times sources due to copyright complications. Dr. John Rothman,

Director of Information Services of The New York Times, describes the underlying issues leading to the development of the Information Bank as follows:

> The Times undertook this project for two reasons: to absorb already existing information services and offer a new service to the outside world and thus create a new source of revenue. (4)

As a part of exploring the "outside" market for this information system, the Information Bank was installed at the University of Pittsburgh on an experimental basis in November of 1972. At that time this university became the first remote user of the Information Bank, and remained the only university in the country to have access to this data base until July of 1974.

As the largest computerized general information retrieval system in the world, (5) The New York Times Information Bank offers unparalleled opportunities for studying various aspects of man-machine communications. The file content appeals to a potentially large user population, and the system has been designed with the concept that each user can interact with the computer without the aid of an intermediary. Rothman comments:

> The genius of the Information Bank is its sophistication combined with ease of operation. It is possible for a relatively untrained person to get the information he wants; even the most complex searches can be completed within minutes by a novice. (6)

The uniqueness of the opportunity for research with the Information Bank was not overlooked by the staff of the Campus-Based Information System at the University of Pittsburgh. As the mechanics of the operation of the Information Bank were smoothed and a general trend in usage established during the first year, more attention was given to the systematic gathering of information about the user population and their reactions to the system. It was through such observations that the total dependence of the first-time users on the Information Bank attendant became noticeable.

At first glance, this observation seemed to be in total conflict with the aim of the Information Bank as a "self-teaching and self-service" (7) system. However, upon closer examination, it became clear that the system had confronted a totally new user population for the first time. In this academic community one could no longer rely upon a relatively small and permanent group of users who intended to refer to the Information Bank as a part of its daily activities. Rather, what was to establish itself as the major user population included a very large and transient student group coupled with the casual, somewhat curious, and often skeptical librarians, staff, and faculty members.

Extensive initial publicity, combined with an "open-door" policy—the terminal is situated in the center of a glass-enclosed smoking room on the ground floor of the main campus library—led to an overwhelming reception by the campus community. The majority of users had little time to devote to a thorough training session; and first-time users of the system far exceeded the repeat users who did not need full supervision at the terminal.

As the number of users multiplied, time restrictions had to be placed on each individual request to provide for maximum use of the system. In order to make the most efficient use of time spent at the terminal, two choices were available. One was to delegate all searches to a trained operator; the other, to train each individual user before he began his own search on-line.

Statement of the Problem

In keeping with the objectives of The New York Times Information Bank as a self-teaching and self-service system, the concept of search delegation was ruled out. Such delegation would have defeated the basic purpose of an interactive information retrieval system: that of direct contact between the user and the data base. Thus, various means for instructing first-time

users were considered. These included group demonstrations, video-taped training sessions, a slide show, computer-assisted instruction, and the use of printed guides and manuals. Over-the-shoulder instruction has always been available and is considered by the author to be an irreplaceable mode of instruction under the current circumstances.

As a preliminary step essential to the development of any training effort, the author compiled a list of situations where the users most often asked for assistance. It was observed that problems relating to the mechanics of conducting a search could be delineated from those encountered during the process of term negotiation. As a first step, it was decided to deal with the former problem.

To this end, the author developed an interactive tutorial program for the Information Bank to be used through the campus computer. In designing the program, the basic objective was to familiarize the user with all the steps involved in formulating a search strategy. Total time necessary for the completion of the tutorial was also of the essence. It had been established that most users with real information needs but little interest in the mechanics of the system could not comfortably devote more than thirty minutes of their time to mastering the use of the terminal. Thus, a thirty minute program was considered to be the longest possible introductory session.

Need for the Study

As this computer-assisted instruction (CAI) session began to be used on a regular basis in conjunction with The New York Times Information Bank, it became evident that some controlled tests of its effectiveness would be in order. It was this particular need that led to the present study. However, it was assumed from the beginning that the crucial issue to be

determined was where and how the first-time user faces difficulties during his on-line interaction with the Information Bank. This information could form the basis for any training effort, regardless of the medium to be used in transmission of the instructions.

Looking forward to an increasing user population, The New York Times needs to reconsider the problems of training transient users; those who will want access to the vast pool of information available in the data base, but whose needs are not constant and permanent enough to warrant extensive training. An increasing number of libraries and academic communities have expressed an interest in using the Information Bank as an integral part of their information services programs. It is evident that there will be a growing need to experiment with a variety of training media to find a low-cost and efficient means of providing assistance to the novice, transient users of the system.

Scope and Limitations

This study was conducted to test the usefulness of a particular interactive tutorial program for The New York Times Information Bank. The CAI program was written for the PDP-10 computer, using the University of Pittsburgh's CATALYST programming language. The attempt to analyze user reactions to a computerized data base will be strictly limited to the specific data base and system in question. It must be noted that the formal experiment ended in March 1974; thus, the contents of the data base as well as both printed and on-line instructions reflect the March 1974 status of the system.

The degree of generalizability may be to the user population of the Information Bank in an academic environment. However, it is hoped that certain principles evolving from this study will be of value to other user groups and for future development of similar systems.

The CAI program was originally written for The New York Times data base at its 1973 stage of development, and was later revised to incorporate changes in instructional messages which appeared on-line prior to March 1974.

In order to familiarize the reader with the state of the art in user training for on-line systems, the next chapter will review the general principles of training as well as specific methods of training considered appropriate for users of on-line information retrieval systems.

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CHAPTER II

REVIEW OF RELATED LITERATURE IN USER TRAINING FOR ON-LINE INFORMATION RETRIEVAL SYSTEMS

The advent of technology has led to the design and implementation of sophisticated on-line information retrieval systems which answer the need for fast and accurate retrieval of information. These systems are now being offered to the public through private (such as The New York Times Information Bank), governmental (NASA's RECON), and commercial (SDC's ORBIT) institutions. Working with such systems is no longer the exclusive domain of the information specialist or the librarian. Many systems are being offered for direct access by the ultimate user population: the scientist, engineer, scholar, manager, and student. More and more emphasis is placed upon the importance of direct use; the need to eliminate or at least lessen the role of the intermediary.

This trend must by nature lead to the realization by system designers of the need for effective user training programs. In the 1967 National Colloquium on Information Retrieval, J. M. Cavanagh states that "without thorough training the user may misuse the system or fail to exploit its potential, thereby effectively degrading system performance." (1) F. W. Lancaster (2) rates training alongside systems design, hardware, and the data base as one of the four major factors contributing to the effectiveness of a search in an on-line system. In a more specific instance, P. D. Rae has identified user training as a major obstacle in the use of the SUNY system at the Parkinson Information Center. (3)

It is surprising, then, to witness the general lack of concern for education of users of information services and systems. (4) Although the need for such education had gained national recognition in the early 1960's (5), there have been only isolated attempts to insure a full orientation program for all users. Lancaster's (6) 1970 review of some of these efforts, though not associated directly with on-line systems, provides a background on the types of training programs offered in the United States and Great Britain for the past ten years. His description of the "user orientation program" for the National Library of Medicine's MEDLARS serves as an early example of a comprehensive training session for a computer-based information retrieval system.

At this point, before investigating various training media and facilities, we must make clear distinction between the goals of "training" and "education". D. H. Holding (7) distinguishes the training concept as an effort to learn or teach a given skill, as opposed to education which has broader aims. "In fact," he states, "many of the problems of education are those concerned with deciding what kind of effect we are trying to produce, whereas the problems of training lie in discovering the most effective means of achieving specified results." (8) Of course, this is not to say that there is no overlap between education and training. As Karl Smith (9) points out, the success or failure of any educational (and I would add training) program must ultimately be judged by how well it prepares the person for the actual task. Principles of training are based upon our present knowledge of learning processes and take advantage of information provided by learning theorists.

It is on this basis that Holding classifies training problems under three general categories: (a) training devices; (b) motivation; (c) training

methods. (10) Another problem which the trainer must deal with is task complexity. "In some cases no amount of training will overcome the disadvantages of a task which has been designed without regard to human factors." (11) This statement by Holding is especially applicable in cases where a retrieval system was originally designed for batch processing and was later converted for on-line use. However, in most instances, the trainer has no control over this design aspect.

In present on-line information retrieval systems the principal training device used is the input unit (teletype, CRT, etc.) of the system. All other devices used during the training process are only adjuncts to the "real" equipment.

User motivation has so far been provided by the user's information demands in his work environment. Except for a number of experimental systems designed and tested in academic settings, information scientists and system designers have worked with defined user populations with strong--though not necessarily well-defined--information needs. Although a certain level of motivation is essential to efficient learning, there are few cases where the user does not hold this minimum requirement. Holding (12) points out that with the exception of school children who may be genuinely unwilling to learn, motivational factors surrounding training may not deserve separate consideration.

Thus, of all the problem areas identified, training methods become our major concern. In present on-line information retrieval systems, the following training methods have been used singly or in combination:

(a) printed manuals, guides, and visual displays;

(b) "over the shoulder" or personal instruction by a specialist;

(c) audio visual presentations;

(d) on-line instruction at the terminal. (13)

Of the four methods mentioned, the printed form of instruction has proven to be indispensable. A comprehensive guide to the system is essential for reference purposes. Shorter versions lend themselves more readily to use by the novice or transient population. As Lancaster has observed, "Some printed material will always be necessary." (14)

To determine the effectiveness of printed instructions as the preferred medium in transmitting information about on-line systems, we must first analyze the nature of the instructional messages. The use of an on-line system is a complex task which may be divided into two major areas. First, the user must get acquainted with the physical, step by step "mechanics" of conducting a search. Next, he must learn the techniques of formulating search strategies. Another way of representing this dichotomy is to distinguish "verbal" from "motor" activities. On this issue, Holding comments ". . .what is learned verbally cannot always be translated into action, nor can learned actions always be put into words. In fact, people may remember information verbally or bodily, giving different scores for 'recall' and 'use'." (15)

This statement brings into light two points. One is that printed instructions alone cannot suffice as the only means of training an individual for "motor" activities; the other is that a single method of instruction is not necessarily suitable for every user of the system. Some may be able

to translate "verbal" into "motor" activities more efficiently than others. In describing the Intrex experiment, ...us, Benenfeld, and Kugel report that ". . .no single instruction method or booklet, no single 'style' of presentation, no single compromise between brevity and completeness, seems to satisfy all, or even a majority of users." (16)

Published literature dealing with the effectiveness of "over the shoulder" or personal instruction by a trained searcher in the use of on-line information retrieval systems is scant. However, there seems to be little argument that this method is much more effective than relying solely upon printed instructions. (17) The drawback, of course, is the cost of training individual users in this manner.

The next two methods attempt to overcome the cost effectiveness problem by technically reproducing a representative on-line session by means of sound-slide shows, films, computer simulations, or other forms of on-line instruction. Audiovisual presentations have the advantage of being readily available and portable for use in remote locations. However, they lack the necessary interaction between trainer and trainee. Also, we still face the problem of transfer of learning from a "verbal" or "visual" form to the "motor" or "action" form. Holding refers to the differences among people in their verbal facility and concludes that "learning by doing" is superior to "learning by saying." (18)

This concept is reaffirmed by the Intrex experiment which also reported that "users learn best by doing" and also added that "On-line instruction is more effective than off-line instruction and probably sufficient for most users if the system itself is reliable." (19)

Lancaster identifies three types of on-line instruction, using the system's terminal.

1. Use of the terminal to display a conventional set of instructions that could equally well be presented in conventional printed form.

2. Use of computer-aided instruction (CAI) techniques, either to give the user a one-time introduction to the system or to lead him by the hand in the conduct of an actual search.

3. Incorporation of explanations of specific commands or system features that the user can call up when he needs them. (20)

Another possibility for on-line instruction is a CAI program which is not directly connected to the information retrieval system, but rather is used in conjunction with it. This program may simulate a remote system on a local computer and may be used strictly for instructional purposes.

At first glance, presenting a set of conventional instructions on-line seems to be a great waste of computer time and storage capacity. And yet, this method is most prevalent among present on-line information retrieval systems. Apart from the fact that no extra effort is expended in rewriting the user manual for on-line inclusion, two other points may be brought up in favor of this type of instruction. First, the user may refresh his memory on the use of a particular command or system feature at the moment he needs such information without having to divert his attention to an outside source (such as the user manual or an experienced user). Also, as the Intrex experience revealed, "We find that users have a strong preference for the on-line instruction over the off-line manuals even when these are identical in content." (21) In this report, Marcus and others explain this phenomenon on the basis of the user's misconception that computers are more reliable than manuals as well as his desire to focus on one place only. A more convincing reason which may be added to these observations is the "novelty" factor of on-line instruction together with a

sense of "movement" in actively reading instructions which are being printed on paper or a CRT screen, rather than glancing passively at the same instructions contained in the printed manual.

The third method of on-line instruction, incorporation of explanations of specific commands or system features, is basically a modification of the first method in that there is minimum interaction between the user and the computer during the training process. For example, in the MEDLINE system the user has both the option of receiving conventional instructions on-line before he starts his search, and asking for assistance during his search by choosing from a menu of six possible problem areas. By reporting the type of problem he has encountered, the user is in fact requesting to see a part of the original instructions which dealt with his problem. The explanations offered are textual and require no interaction beyond prompting the computer to continue or stop the instructional messages. No attempt is made to test the understanding of the user concerning the material which was presented to him.

Based on a two year study of on-line information systems and their impact on the user, Theodore Wolfe states that "The importance of the tutorial sequence cannot be over-stressed. It provides the basis for user-computer interaction and by doing so determines in great part the success of potential users of the system." (22) He suggests the use of computer-aided instruction to acquaint new users of the system with query formulation processes using a sample data base. He further credits a good tutorial sequence for its ability to create user self confidence, to increase system efficiency, and thus its marketability. However, as late as 1973, Lancaster states that "Although instruction in on-line searching seems to be an obvious application for CAI, and many writers have suggested this approach, comparatively little work on

this application has so far been conducted." (23) This is not to say that the field of computer-assisted instruction has also remained static in the past few years. Naturally, major efforts in designing and testing CAI systems have been in educational settings.

The most comprehensive and well documented program dealing with the use of CAI in elementary and high school settings was started in 1963 at the Institute for Mathematical Studies in the Social Sciences at Stanford. (24) An equally important program concerned with the use of CAI in higher education is the University of Illinois' PLATO system. Both programs have been active in seeking new ways to reduce the operating costs of computer-assisted instruction. (25)

Although these and numerous other studies (26) have shown to most everyone's satisfaction that CAI is at least as effective as the traditional modes of instruction, there are few who would argue with G. . Young's assertion:

> One of the problems that we face in designing computer instructional programs is the fact that we know almost nothing about the deeper psychology of learning . . . With or without the computer, we do not know the real implications, only the logical implications, of various choices in the curriculum. (27)

Again we become aware of a difference in the problems facing an "educator" as opposed to those encountered by a "trainer". Although we must not ignore the underlying issues of the psychology of learning, our goals are quite clear and we are indeed concerned with the "logical implications" of the training program.

For training users of on-line information retrieval systems we must design a program which will be competitively effective in its teaching capabilities, take the least amount of user time and be cost effective. Atkinson

remarks that the evaluation of a CAI program is ". . .primarily. . .an evaluation of the instructional program and as such is basically an evaluation of the program designer who is the real teacher in a computer-assisted instruction system." (28) Thus, for training purposes, if the program designer is also an expert searcher and is fully familiar with every aspect of the user/system interface, he may be capable of producing a CAI sequence which will be at least as effective as his conducting a live session of the same duration.

CAI has the most promising prospects as a tool for training users of on-line information retrieval systems. It serves a double purpose in that it conveys instructional messages while preparing the user for the type of interaction which he must get accustomed to in working with an on-line system. That is, the form (device) as well as the content is useful to the trainee. CAI plays an active part in the teaching process as opposed to the passivity of printed guides or listening to an instructor. In a sense it forces the trainee to keep us with the reading and to practice what he has just learned.

The "hands on" experience, mentioned before as being an important element in the learning process, is ever present in CAI interaction. Caruso simply states "Interactive programs require a tutorial approach." (29) Ultimately, if the CAI were enmeshed with the retrieval system, the ideal learning environment would be attained. Robert Reinecke (30) has reported on a system based on this concept which is now operational at the Vision Information Center of the Harvard Medical School. Heer and Foyle (31) have also described the use of a CAI program in conjunction with a retrieval system.

From a motivational standpoint Ivan Russell claims that CAI offers additional incentive through "manipulation of the device, the freshness of

the experience, intrinsic qualities of the learning content, and reinforcements given by the computer's reactions to the student's responses." (32)

There will always be two types of users in most on-line information retrieval systems: the information specialists and the practitioners in various fields. The training procedure for members of one group may not necessarily be appropriate for the other. Most training programs to date have been aimed at the information specialist who can afford to spend longer hours on the training process.

The experience at NASA's Goddard Space Flight Center is notable in this respect. Scientists and engineers at the Center were not using their on-line information system (RECON) directly. Final analysis revealed that since these individuals did not have frequent need to use the system they had not developed the needed proficiency in handling system mechanics. Del Frate and Riddle comment that "At the present time we do not forsee that there will be any significant increase in direct user use." (33) And yet they end with this note of optimism: "Since dreams die hard, we will continue to try to build up a hard core direct user group of new and repeat users." (34)

It is thus imperative that short and effective training programs be developed to satisfy the needs of this growing user population. Experiments must be conducted to determine the effectiveness of various training media designed specifically for transient user groups. We must plan for the future of on-line systems and be prepared for the type of users it will attract. This can only be done if we take a fresh look at our present training tools and practices.

By placing the greatest emphasis upon training needs of the user population, it has not been the author's intent to minimize the importance

of other features of an interactive information retrieval system. Options related to query formulation as well as result manipulation are also of paramount importance to the user.

A recent study by Thomas H. Martin (35) at the Institute for Communication Research of Stanford University explores the user needs through a feature analysis of eleven on-line information retrieval systems. The minimal features recommended by the systems designers questioned by Martin are used as a basis of evaluating The New York Times Information Bank user/system interface. Some of the concluding remarks by Martin are appropriate to the ultimate goal of establishing inter-system compatibility:

> What is needed is not agreement regarding the syntax of retrieval languages but agreement regarding features which all systems should possess.
>
> . . . . . .
>
> If steps are taken now to insure that systems respond to the functional needs of users, and that they share common features, then in the future it should not be difficult to couple them together into a national or international resource. (36)

One of the primary steps which would insure "that systems respond to the functional needs of the users" is to ascertain that such functional needs are fully understood and taken into account by system designers. One of the objectives of the present study is to present those needs which have come to light during the training process of first-time users of the Information Bank.

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CHAPTER III

METHODOLOGY

In relation to other studies concerned with user training for on-line systems, a number of questions came to mind at the inception of this inquiry:

1. What are the steps involved in the learning process of the novice user of the Information Bank?

2. What is the most advantageous medium for training transient users of this on-line system? Is any one medium better suited than others for this purpose, or does the answer lie in a well-balanced combination of several media?

3. Given a similarity in the content of instructional messages, does the user respond better to CAI programs or to printed instructions? Is there a significant difference in the user performance at the Information Bank terminal between the two groups subjected to these training media?

4. Does learning the mechanics of the system "guarantee" a successful search in cases where the needed information is clearly within the range of information covered in the data base? In other words, how important is the user's familiarity with The New York Times thesaurus and the concepts underlying an on-line search strategy?

5. Are there certain categories of users who will be unable to cope with the computerized information retrieval system regardless of the initial type of instructions they receive, and why?

These and similar questions should be the concern of the system designers as well as those involved in user training for on-line systems. The scope of the present project does not allow for an in-depth study of all issues related to the topic of user training. However, the following hypotheses encompass a number of the above questions.

Hypotheses

1. The computer-assisted tutorial program for The New York Times Information Bank, in conjunction with printed instructions, is a more effective tool than the printed instructions alone for learning to use the Information Bank.

2. The learning process at the terminal is divided into two separable areas: the mechanics of formulating a search strategy, and mastering the use of The New York Times thesaurus.

Assumption

In addition to the system messages displayed on The New York Times Information Bank screen, there is a need for supplemental instructions for the first-time users of the system.

The Tutorial Program

A computer-assisted instructional program was designed to simulate the Information Bank search process. The user was asked to conduct a search on "the relationship between automobiles and air pollution in 1972." This was considered to be a typical request from the Information Bank. It was a topical item requiring the use of two terms ("automobiles" and "air pollution"), one modifier (year: 1972), and a Boolean operator (AND). The program allows for the interaction the user would normally encounter in a real search on the

Information Bank as well as additional explanatory comments when the user fails to make the expected responses. A sample interaction with the program is included in Appendix B.

Methodology

The experimental design called for testing the effectiveness of the tutorial program by the rate of success the participants displayed in conducting an actual search on The New York Times Information Bank. A comparable group of participants was restricted to using printed instructions as the only means of getting acquainted with the system. Their performance on the Information Bank was used as the control measure against which the tutorial group was judged. A feasibility study was carried out to confirm the soundness of the design. Minor changes were made in the formal experiment based upon the findings of this early study.

In order to further assure uniformity in results and allow for a fair comparison of the two groups, the following precautionary measures were taken:

1. The final analysis of data was strictly limited to those obtained from first-time users of the system who had had no prior exposure to the Information Bank.

2. Questions to be answered on-Line as a part of the feasibility study were designed to test the full capabilities of the system. Participation in the formal experiment required a screening of the user's information needs. Only those individuals whose query seemed to reflect the data base contents and full use of system capabilities were asked to participate in the experiment.

3. Unnecessary interaction between the experimenter and the participant did not interrupt the flow of the search process. Participants had been assured that a parallel search would be conducted for them if they were unable to obtain expected results. They were also informed that all of their questions concerning the system would be answered immediately upon completion of the experiment.

4. The amount of verbal information offered each participant was kept constant in all cases. Whenever the participant insisted upon an answer to a question which would affect the outcome of his search strategy, the experiment was considered "terminated" at that point in the search when the user's first question was answered.

5. It was not the intent of this study to measure the participants' degree of frustration. In cases where visible signs of over-anxiety or frustration interfered with the normal search process the experimenter gave verbal assurance that the participant was not obligated to complete the full search. It was assumed that such cases would have terminated the search under non-experimental conditions. As the object of the experiment was to replicate the real-life situation, it was deemed unnecessary to apply any pressures to the participants which they would not have normally encountered in a visit to the Information Bank.

Data Collection and Measurement

Other than obtaining the printout of interaction with the tutorial program, all data collection was based upon direct observation and questioning of the participants. Extensive notes were taken during the user interaction with the Information Bank, reflecting every step of the search as well as all comments offered by the participant and his physical behavior during the search

process. Thus, the major findings of the study reflect the experimenter's personal view of the user/system interplay.

On a more objective level, the following data were obtained for each participant in the formal experiment:

A. Personal characteristics and background information.

B. Total time spent on training (tutorial and printed instructions).

C. Total time spent on searching the Information Bank.

D. The step at which the first significant error was made by the participant in an on-line response to an instructional message.

E. The last step successfully completed on the Information Bank terminal.

Although a quantitative analysis of the data will yield concrete evidence as to the effectiveness of the tutorial program, it has been the author's intent to use the qualitative findings of the experiment to analyze the more subtle reasons for search failures. The author finds it more important to follow the user's trend of thought leading to a misinterpretation of an instructional message than to simply record--and report--an error when it occurs. Although it is possible to provide quantitative results in relation to an occurence of a certain error, as will be shown in chapters 5, 6, and 7 there are often a variety of reasons behind any single form of error.

The New York Times Information Bank computer may be programmed to systematically record all incorrect responses to instructional messages, but what will be lacking from such a record is the reason for the user's failure to respond correctly. The major contribution of this study, though be it subjective, is to provide the system designer with a glimpse of the user's thought pattern as he first encounters an on-line bibliographic information retrieval system.

Definition of Terms

The reader is referred to Appendix A, the User Guide to the Information Bank for a glossary of terms used in connection with the system. The following terms or phrases have been used with a special meaning throughout this study.

"Blue Card" refers to the one-page printed instructions accompanying the tutorial program, which was also made available to the non-tutorial group. It gives a brief explanation of the stages of a search and provides the user with a list of "universal options" or commands available on the Information Bank. A copy of this card appears in Appendix B.

"Non-tutorial Group" refers to the control group of participants who received only the printed forms of instruction prior to conducting an on-line search.

"Normal Search" refers to what has been established as a typical search on the Information Bank in this academic community. It consists of the logical combination of two terms which have already been restricted by a single modifier. The modification is typically a specified date or date range, and the Boolean connector is an AND.

"Search Failure" applies to the failure of the user to obtain the desired results as defined by a "Successful search". Its various causes are described in chapter 5.

"Significant Error" as applied to an error occuring during the course of an on-line search refers to an error which is not detected by the user prior to its entry into the system. It is an error which alters the sequence of search steps, and thus directly affects the search results or the user's perception of the search process.

"Successful Search" refers to a search which has yielded positive and complete results as judged by the participant. For the purposes of this experiment, the participant is the final judge on the usefulness of the obtained documents.

"Tutorial Group" refers to the participants who were requested to complete the CAI training program before conducting an on-line search on the Information Bank.

"Typical Search"; see: "Normal Search".

CHAPTER IV

CONDUCT OF THE EXPERIMENT

A total of 99 individuals participated in the experiment to test the effectiveness of the CAI program for The New York Times Information Bank. The formal experiment was preceded by a feasibility study which was carried out as follows.

A group of volunteers from the Mechanized Information Retrieval course offered at the Graduate School of Library and Information Sciences was randomly divided into two groups on the basis of a pre-set appointment schedule. That is, once all appointment hours were filled, every other participant was assigned to the tutorial group at the moment he arrived for the experiment. Thus, no participant had prior knowledge of his group assignment, and the experimenter had no control over the sequence of appointments made.

Each group was given the same basic information about The New York Times Information Bank and the general manner in which the experiment would be conducted. Each of the subjects in one group was required to take the interactive tutorial program before proceeding with his search. Individuals in the second group were directed to the Information Bank terminal without receiving any further instructions.

At the terminal, both groups were given a basic orientation to the equipment. The user guides, thesaurus, and other printed instructions furnished by The New York Times were available for use by all subjects. Questions to be searched were controlled by the experimenter so that involvement

in term negotiation could be kept constant and at a minimum. These questions were written on individual cards and selected at random by the user. No question was used more than once for each group. The purpose for this control was to discourage the participants from discussing the search topic with other participating members of the class.

Because of the objections raised to some of the test questions as being irrelevant to the needs of the participants, thus thwarting motivation, the formal experiment relied upon inquiries of genuine interest brought by each participant.

The formal experiment was further divided into two sections. Section I was a repetition of the feasibility study, using volunteers from the entire academic community, and conducting the search on a topic of personal interest to the participant. Assistance in term selection was offered prior to the on-line search to offset any difficulties the user may have faced in translating his inquiry into "key terms" acceptable to the system.

Section II differed from Section I in only one respect. No off-line term negotiation was offered by the experimenter. The purpose for this single variation was to evaluate the effect of familiarity with The New York Times thesaurus on final search results. It was assumed that if such familiarity is essential to the conduct of a successful search, the success rate would drop significantly for Section II.

Analysis of data and results of the study will be discussed in chapters 5 and 6; followed by an analysis of the instructional media in chapters 7 and 8.

CHAPTER V

THE EXPERIMENT FEASIBILITY STUDY: PRELIMINARY DATA ANALYSIS

To test the feasibility of the planned experiment, a group of students from the Graduate School of Library and Information Sciences was recruited to participate in the evaluation project for the first tutorial program. These students were all enrolled in a course on mechanized information retrieval offered at the Master's and Ph.D. level.

A total of 46 appointments were set up, four of which were cancelled due to other commitments by the participants. Of the remaining 42, the following cases were eliminated from the final analysis:

System's mechanical failure: 2 cases

Participants ran out of time or did not concentrate properly on the experiment due to time pressures: 2 cases

Those randomly selected for the control group who had previously used the Information Bank: 3 cases

The quantitative results of this experiment are reported in tables 5.1 through 5.9. The control group is referred to as "non-tutorial" throughout this report.

The participants in this experiment were predominantly female, reflecting the overall enrollment pattern in the Graduate School of Library and Information Sciences. The majority of the participants were working toward their first graduate degree and only eight of the thirty-five had had any previous experience with computers. It may be noted that the

random selection process placed five of these eight into the non-tutorial group. Three of these five had used computers in a time-shared environment.

Except for two individuals with a science background--one in mathematics and the other in biology--the rest had degrees in the social sciences and humanities, with a majority in English literature and education. Well over half of the participants had no familiarity with the printed index of The New York Times.

The total time spent in completing the tutorial program is noted in table 5.2. No similar figures are available for the amount of time taken by the non-tutorial group to read the printed instructions and manuals. It was especially difficult to obtain accurate measures for the non-tutorial group as they had been instructed to read the short handout (see Appendix B) in advance of their appointment. Although they were given the opportunity to read or review the guides upon arrival, most participants expressed a desire to start the search at once and refer to the manual during the course of the search rather than take the time to read all instructions before starting. Thus, the total time reported for the non-tutorial group in table 5.3 reflects the time taken to review the manual as well as time taken in interaction with the computer.

Of the nineteen participants who took the tutorial, twelve completed the program in thirty minutes or less. In this group of twelve, eight had fully successful searches on The New York Times Information Bank, while the success rate for the rest of this group (those taking longer than thirty minutes on the tutorial) was one in the remaining seven cases. This figure compares well with the zero success rate reported for the non-tutorial group. (see table 5.4). In looking strictly at the participants' abilities to follow

through the "mechanical" steps involved in a normal search on the Information Bank, we find that the success rate is 12 out of 19 for the tutorial group and 3 out of 16 for the non-tutorial group.

Before concentrating on the specific errors made by each user and their significance on the search results, we must consider the general categories of errors which commonly lead to search failure.

In an in-depth analysis of searches conducted under experimental conditions as well as drawing upon extensive knowledge gained while assisting in the execution of over two thousand searches during a two-year period, four separate and distinguishable types of errors have been isolated:

1. Conceptual errors
2. Thesaural errors
3. Mechanical errors
4. Interpretation of on-line instructional messages

Of course, this does not mean that there are no overlaps between these groups. In fact, most common errors are caused by an intermingling of two or more types of individually recognizable errors. These cases will be discussed once the basic boundaries of each individual type of error has been established and explored.

1. Conceptual Errors

These errors are of two basic types: those dealing with pre-conceived notions about the capabilities of computers in general, and those directly involved with the user's concept of The New York Times Information Bank.

The pre-conceived notions themselves can be divided into two major classes of favorable and unfavorable origins. The computer is seen by some only as a "monster"; an inhumane, ruthless and menacing machine which can

cause nothing but trouble. On the other extreme are those who believe that "if it is a computer, it can do anything, answer any question." It is often quite essential to know about these preconceptions as they color the entire search process, even though it may be the user's first actual experience with the computer.

On a more specific level, conceptual problems relating to The New York Times Information Bank fall into the following categories:

A. Some users do not realize the inevitable sequentiality of the steps involved in any given search. They do not grasp the idea that each step has its own unique set of instructions and that an acceptable response to a given step is essential before the computer can take them to the next step.

B. As an extension of the above, some users feel that the computer will not accept a message from them unless it is the "right" choice for that step, and that it will not offer an option unless it is applicable to the search at hand. This feeling is reinforced by the fact that they may have encountered an error message from the computer on the first few steps and decided that whenever they make an error—though it be judgemental rather than mechanical—the computer will inform them of the error.

C. There is also the concept of "unrelatedness" between the instructional messages and the on-line thesaurus. For example, at the point of term entry or term selection the computer does not analyze the index terms chosen by the user and give instructions according to the type of information requested. When the system message relates "Try an inversion of this term",* this does not necessarily mean that the inverted form of

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*In order to preserve the integrity of messages appearing "on-line," punctuation marks which are not a part of system messages appear outside quotation marks throughout this report.

this term is in fact a legal descriptor. Likewise, if the user chooses the subject of "economic conditions and trends" and then proceeds to modify this term by "sketch" or "byline", the computer is not equipped to respond at once to an error of this type. But the user assumes that if the option was made available to him, then it must be "legal" and applicable to his search. He may also assume that the computer "understands" the concept of his question rather than simply responds to the terms used.

D. Another instance of a conceptual problem is when the user feels that there is an unknown element ahead of him. He may state his problem this way: "You never know what the next step is going to be, so how am I expected to proceed with my inquiry?" An excellent example of this is the user who types his date modifier at the point of term entry. He is not sure that later in the search there will be a specific step which will ask him for date modification. This individual expresses surprise when an experienced searcher moves rapidly from one step to the next without seemingly reading the instructional messages. He asks: "But how can you tell what the next step is going to be?" Unfortunately, printed instructions such as the User Guide to the system do not fully satisfy the information needs of this user.

E. A totally different set of conceptual problems occur in dealing with the logical connection between terms. This problem presents itself at two separate and distinct stages in a search. First, the user may start his search with the idea that his terms will be automatically connected at the point of term entry. Some even go as far as stating their query in terms of Boolean logic at this point. Here, the user becomes totally confused when he encounters only one of his terms (the last one he typed) on the first term selection screen. He asks, "But what happened to my other terms?" Or he

selects the option to "view continuation" on the first term, assuming that somewhere in the thesaural display he will encounter the logical combination of all his terms.

The same conceptual problem reappears, of course, at the logic stage. At this point the user may show his misconception about the logical AND and OR. He will usually use the Boolean AND connective when he really means to use OR.

F. As with the logical connectives, there are also other conceptual problems related to specific stages of a search. Those dealing with term entry have already been stated. Problems with modifiers are less common but nonetheless apparent, especially in cases where the user feels that he should be able to modify his search at the point of term entry. Many users insist upon entering a date (such as 1968, or 1973) as a separate "term." They may even go as far as selecting such a "term" as it appears on the screen and conceptually linking it with their own search. A common example is the case of the various congressional sessions which are represented by year in the on-line thesaurus. An individual doing a search on "education and schools" will automatically accept the term "1973 session" as one dealing with the academic year or school session, assuming that the computer had recognized the search as being education-related.

As stated earlier, it is very difficult to differentiate between purely conceptual types of errors and those which deal with definitions of the instruction, the mechanics, and the thesaurus-related portions of the search. Quite often what appears on the surface to be a "mechanical" or "thesaural" difficulty turns out to be a conceptual misunderstanding on the part of the user.

2. Thesaural Errors

These errors can also have many variations:

A. In a controlled vocabulary system there is always the problem of relating the terms used by the non-specialist to that of the system thesaurus. Many of the search failures are due to a lack of understanding of what terms are acceptable to the system and how certain questions may be manipulated to fit the system vocabulary and produce the desired output. As an example we may cite the case of an individual needing some references on the attitudes of Americans on a topical issue (such as race, politics or religion). The first-time user is quick to discover that the term "attitudes" is not acceptable to the system. Even after many tries he may not discover the term "public opinion" or "Gallup Poll" as alternatives which may serve his purpose.

Also in the thesaurus-related area, but on a somewhat more conceptual level, we must address the problems relating to the manner in which appropriate terms must be chosen for querying the Information Bank. It is difficult to convince some users that they must choose "concrete" or "objective" terms rather than "subjective" or soft, generic terms. It is hard for some users to understand that the terms "major issues", "potential", "valuable" or "projected" are unacceptable to the system.

B. Other than difficulties inherent in the use of systems with controlled vocabularies, there are certain idiosyncrasies specifically related to the on-line thesaurus of The New York Times. Many individuals have asked "How do you get material about California (or Nepal, or New York City) which is not about its geography?" The problem being that the modifier "GEO" attached to the term is interpreted as the "geography" of the area rather than its "geographic" location. A number of the experimental searches

failed because of this simple misinterpretation of material presented through the on-line thesaurus.

Similar problems are encountered in looking at cross-references tagged with obscure abbreviations which are not defined or even spelled out on-line. These abbreviations (such as SAG and SAØ) are, however, defined as part of the glossary on page 30 of the User Guide.

C. Simple indexing errors, to be expected in such a large and active vocabulary file, also lead many first-time users astray. Inconsistent uses of hyphenation or inversion, to name two common instances, may separate the articles dealing with a particular topic into two or more files which do not necessarily follow each other alphabetically and are thus lost to the uninitiated.

D. An area which may be classified as having both conceptual and mechanical elements is the right truncation feature of the on-line thesaurus. Two separate issues are involved here. First, many users are not convinced that the truncation feature actually works. That is, they insist upon entering the full form of the term in question once they have received a message that the truncated form of their term is "not in the file". This is basically a mechanical duplication of effort and by no means serious; it only adds to the on-line search time. The next issue, however, can affect the entire search strategy. Once the uninitiated user "enters" a term into the system and is confronted with a screenful of terms (beginning with the last term he had typed), his immediate interpretation is that all of these terms are somehow related to his search. He may not visualize the list as being strictly alphabetical. He is either annoyed at receiving "unwanted" items, or overjoyed by the thought that the computer has found not only the one term he had asked for but a lot of related terms he did not know existed in the file.

The "connective" concept described under 1.E. above is also visualized here. If the user had originally entered two or more terms into the system, as soon as he sees the first screen offered for term selection he starts looking down the list to find the entry which has combined all of his terms. This user may ask to "view continuation" through numerous screens in search of that elusive descriptor which fully defines his search topic. Here is the case of a conceptual problem affecting term selection. In the process of looking for that "ideal" term, the user invariably bypasses the single term which he should have picked from the first screen.

E. The number of postings for each on-line thesaurus term is given in a binary range opposite that entry. There are few, if any, novice users who pay attention to this very significant piece of information. However, even when the user's attention is drawn to the number of citations, his intuitive reaction is to stay away from large files. This type of judgement is disasterous for most searches using the AND logic, the most common search strategy on the Information Bank. The user states "But I don't want to see 4000 citations; especially when I am not even sure that this is the right file." Again, he has conceptually lost sight of the fact that a logical AND intersects two files and drastically reduces the output and that he must start with a large enough file if he expects a reasonable amount of output.

F. Automatic showing of cross references to particular index terms as well as automatic switching from an acronym or synonym to the legal descriptor can also become a source of great confusion to the novice user.

Suggestions for alleviating some of the above problems appear in chapter 8.

3. Mechanical Errors

As with the conceptual issues involved in a search, there are also two basic types of mechanical problems. First, there are those individuals who are quick to admit that they have no affinity for mechanical objects. "I have trouble operating a can opener," offered one participant as she approached the terminal. She also expressed a fear quite prevalent among first-time users; the fear for "breaking the machine" or somehow hurting it by pressing the wrong keys. "I don't like machines" is a rather common expression for those who show visible signs of nervousness at the terminal. An "inherent mistrust of computers" is stated as the cause for anxiety by others. Dealing with individuals of this type may in itself be a valid subject for in-depth study; it is, however, beyond the capabilities of the search assistant to analyze such behavior and prescribe remedies. At best, he may ask the individual to stand by while he conducts a search and explains the basics of the search procedure to the patron.

Here, we are concerned with another type of user group; those who have no overwhelming fear of the terminal and are at least receptive to the idea of trying a search on their own. This type of a user may face any one or combination of the following mechanical problems:

A. Purely mechanical errors may be as simple as missing the letter "A" on the keyboard and pressing the shift key which is immediately to its left. On an Incoterm keyboard such action turns on a red light under the shift key. The novice user is immediately alarmed at having done some irreparable damage. Few are able to recognize the problem for what it is and solve this minor mystery without the aid of an attendant.

Of far greater concern are the various typographical errors made; one of the most common being the use of the small letter "ℓ" for the numeral "1". This is more evident with those who are experienced typists. Thus it is even more frustrating for them to get "incorrect" messages from the computer regarding their typing skills. Also, because the computer's response to typographical errors is simply "incorrect response to message. Please re-read instructions", the user may misinterpret the message and assume that he should have used a different option, format, or term number rather than what he had used.

Two factors aggravate this problem. First, many novice users have never worked with a touch keyboard. They are not aware that they may be accidentally printing a letter twice by gently tapping on the key. Second, once the error message appears on the screen, the user's original message has been erased. Thus he no longer has access to what had triggered this computer response. This is very crucial since in most instances of typographical errors the user is totally unaware of his mistake. For example, if he had unwittingly typed "bb//1" while he had thought of typing "b//1" and received an error message, he would assume that he should have used a different option such as "A//1", or a different format such as "b1//". Or he may even conclude that he should have chosen another term number. This user is now a prime candidate for becoming conceptually confused due to a simple mechanical failure.

B. Some mechanical problems contain an inherent conceptual factor. For example, pressing the "Enter" key to relay a message to the computer carries with it many unidentified images in the user's mind as to the real meaning of this mechanical act. These images determine his behavior at the

terminal. They will determine how long he is willing to wait for a response and what he will do with his time while waiting. An unexpected delay usually leaves the user anxious and uncomfortable. He may start pressing the "Enter" key over and over again or he may retype his message—though the keyboard is locked and will not register his typing efforts. If he happens to know about the "reset" and "erase" keys on the keyboard, he may reset the screen and type in another message on the assumption that it was his original message that had caused the delay. All of this, of course, is time and effort wasted by the user. It will leave an unfair impression in his mind and color his judgement of the entire system.

C. A separate set of mechanical errors are those caused by misinterpretation of on-line instructional messages. These errors, categorized by their cause rather than effect, will be dealt with in the next section.

Barring unusual circumstances, pure mechanical errors do not cause search failures. It is usually a deeper problem with "mechanical symptoms" which forces an individual to abandon a search. It is not unusual, however, for a person with low tolerance, to discontinue a search because of receiving repeated error messages due to purely mechanical errors.

4. Interpretation of Instructions

A. It is quite likely that the uninitiated user may find a totally wrong, yet justifiable, definition for phrases such as "system messages", "view continuation", "Quit=A", and the like. These messages appear on specific screens of The New York Times Information Bank and as such will be discussed in detail in chapter 8. In order to avoid a duplication of such discussion at this point, the reader is referred to that chapter for further information on search failures due to the misinterpretation of instructional messages.

B. Quite apart from the misinterpretation of instructions, there are those cases where the user is unable or unwilling to decipher or interpret the instructional messages. Rather than chancing misinterpretation, the user simply sits staring at the instructions and avoids making any decisions. This happens most frequently at the initial stage of a search. Phrases such as "I don't understand. . .", "what does it mean. . .", "it makes no sense. . ." and the like are more common at the identification stage and system message screens than at any other point in the search.

It may be argued that we are really confronted with conceptual problems at this point, but it is difficult to substantiate this case. In most instances if the user is pressed for a reason behind his statement, he will refer to the specific instruction at hand rather than admit (if that is in fact the case) to a broader conceptual confusion.

Instructional messages are the most common cause for errors commited on-line, but it bears emphasis that the cause of search failures cannot always be pinpointed to a particular type of error. It is much more likely that a combination of all four types of errors lead to an unsuccessful search. While table 5.5 identifies the dominant type of error in a given search, an in-depth analysis reveals a variety of interrelationships.

In the case of conceptual errors, ten of the fourteen cases led directly to other recognizable problems. Seven cases showed immense difficulties in performing the mechanical functions of the search, while three cases led to inadequacies in dealing with the thesaurus. The results also show the positive effect of the tutorial in acquainting the novice user with the underlying concept of an on-line search of The New York Times.

However, the tutorial group, somewhat relieved of coping with the search concept was strongly affected by thesaurus difficulties. In the majority of cases, conceptual difficulties took precedence over thesaural and mechanical problems; while on the next level of performance, mechanics of the search had to be mastered before the user showed any evidence of getting involved with the thesaural question. Thus, those individuals showing the greatest involvement (and hardship) with the thesaurus had had a better grasp of the conceptual and mechanical parts of a search. The failure of the tutorial program in this respect becomes evident when we note that eight of nineteen participants in this group had thesaural difficulties. On the other hand, the six cases displaying no major difficulty in any of the three areas were all from the tutorial group.

Table 5.4 shows that sixteen out of the thirty-five participants "picked needless terms." This number which was rather evenly divided between the tutorial and non-tutorial groups represented a majority of the cases which had reached the logic stage. Keeping in mind that the questions being searched were carefully selected to require only two terms to yield successful results, we find a total of 128 terms appearing at the logic point of twenty-one searches. Thirty of these terms were duplicates; that is, due to mechanical errors (mostly misinterpretation of instructions) many participants selected the same term more than once. On the average each participant selected six terms where two would have sufficed. Some participants ignored the extra or duplicate terms and succeeded in making correct logical combinations. Others were also able to complete the logic step—though with little apparent knowledge of the underlying concept. A few examples may be noteworthy.

In response to a question concerning "Mercy death (Euthanasia) in New Jersey during 1973," one participant selected the term "mercy death" on four separate occasions. Thus, at the point of logic, this term was repeated four times with four term numbers. The logical combination made by the user was: "b//1 or 2 or 3 or 4" as though these were four separate files dealing with the same topic. This individual, as well as the one performing the next search to be described, was unable to select the "New Jersey" file because of misinterpreting "GEO" as the geography of New Jersey rather than its geographic location.

The second participant with the same question had selected the term "mercy death" twice. At the logic point seven different but incorrect logical combinations were made before the eighth response was accepted. The final logic was: "b//1 and 2 and 1 and 2 and 1 and 2", terms 1 and 2 both being "mercy death."

On another topic, "Water pollution in the Great Lakes in 1973," one participant selected a total of 24 terms, seven of which were duplicates, from the alphabetic list of terms offered on-line. At the logic stage each one of these terms was linked to the others by an OR logic. This individual fully comprehended the Boolean logic concept. She explained her search strategy on the basis of this assumption: as you pick terms from the on-line thesaurus and they are saved for you, it seems that each term is being added on to what you had picked before and that in fact a logical AND connection is built up by the time you reach the logic stage. Thus the need for an OR logic at the last step.

Tables 5.6 through 5.9 reflect some of the quantitative data related to the errors made during the tutorial and the Information Bank sessions. It

is quite apparent that the tutorial session takes a great deal of learning pressures off the actual search on the Information Bank. Just as 14 out of 16 participants from the non-tutorial group made their first error on the first step of the search, so did 15 out of the 19 from the tutorial group make that error on the first step of the tutorial. On the other hand, this figure dropped to less than half the total cases when the tutorial group approached the Information Bank.

On the whole, the tutorial group made fewer errors and completed more steps on the Information Bank than the non-tutorial group. The tutorial group averaged a minimum of 2 errors while completing an average of 8 steps. The non-tutorial group averaged a minimum of 6 errors while completing an average of 3 steps.

The feeling of frustration or being "stuck" was not uncommon among the members of both groups. Six of the 19 in the tutorial group and 10 of the 16 in the non-tutorial group expressed such feelings quite openly. Many commented that they would not have tried using the Information Bank without help, or that they would not have spent as much time trying if they were not participating in an experiment. Although the participants were free to end the session at any time, and some were even encouraged to do so because of visible signs of over-anxiety, none gave up easily once they had gotten involved in the search process.

However, two of the thirty-five participants did not wish to perform a search on The New York Times Information Bank. Both individuals had preconceived notions about the difficulty of working with computers and felt that, on their first encounter, they would prefer to watch someone else work with the terminal. One participant who had completed the tutorial session

finished the first step on the Information Bank terminal and abruptly stated that the "system (is) definitely not for slow learners or old people like me." The other participant simply said "You try it—I'll watch."

Comments such as "First time is overwhelming," "I'm completely bewildered," and "I'm tired of reading instructions," were countered by those who sensed a great deal of triumph and joy in working with the Information Bank. One user who had spent 67 minutes at the terminal without success commented: "I liked it! Really enjoyed it; could stay with it all day." Another expressed relief: "I made it through!" Most everyone said that he will come back to use the Information Bank. But there are always those who are hard to please: "I would have gone straight to the printed index (of The New York Times) if no (human) help was provided with the system."

Comments on the tutorial program were generally favorable. Suggestions were offered for clarifying the language at the "term selection" step as well as "toning down" the responses given to some of the incorrect messages relayed by the users. Many adjustments were made in response to these suggestions. Two help routines were also added at the point of term selection and logic. The effect of these changes, as well as a more detailed analysis of user comments on the tutorial will be studied in chapter 7.

Table 5.1

Background Information on Participants in the Feasibility Study

Topic	Number in Tutorial Group	Number in Non-tutorial Group	Total
Sex:			
Female	17	14	31
Male	2	2	4
Last degree obtained:			
Bachelor's	16	14	30
Other	3	2	5
Educational background:			
Social sciences/humanities	18	15	33
Science	1	1	2
Previous computer experience:			
Any contact (batch or on-line)	3	5	8
On-line use (time-sharing)	1	3	4
Familiarity with The New York Times Printed Index	9	5	14
Number of participants	19	16	35

Table 5.2

Total Time Spent in Completing the Tutorial Program

Number of Minutes	Number of Cases
16-20	2
21-25	5
26-30	5
31-35	2
36-40	1
41-45	3
46 and over	1

Table 5.3

Total Time Spent Searching The New York Times Information Bank

Number of Minutes	Number of Cases (tutorial group)	Number of Cases (non-tutorial group)	Total
0	0	2	2
1-5	1	1	2
6-10	2	0	2
11-15	5	0	5
16-20	3	4	7
21-25	2	0	2
26-30	1	1	2
31-35	2	2	4
36-40	3	2	5
41-45	0	2	2
46 and over	0	2	2
Total	19	16	35

Table 5.4

Search Results

Observation	Number of Cases (tutorial group)	Number of Cases (non-tutorial group)	Total
Search "mechanically" completed with by-pass*	-	2	17
Search "mechanically" complete. No reservations**	12	3	15
Accepted negative result as final output	3	1	4
Picked needless terms	9	7	16
Search successful	9	0	9

* This group includes those cases where one of the steps such as modification or logic may have been bypassed

** This group includes only those cases which completed every step necessary for a successful search

Table 5.5

Dominant Factor in Search Failures on
The New York Times Information Bank

Type of Problem	Number of Cases (tutorial group	Number of Cases (non-tutorial group)	Total
Conceptual	4	10	14
Thesaural	8	3	11
Instructional	-	2	2
No dominant problem (successful search)	6	-	6
Participant did not wish to conduct a search	1	1	2
Total	19	16	35

Table 5.6

First Significant Error Made in the Course of the Session,
Including Those Which May Have Subsequently Been Corrected

NYTIB Screen	# of Cases in the Tutorial Session	# of Cases on NYTIB By the Tutorial Group	# of Cases on NYTIB By the Non-tutorial group	Total on NYTIB
1: Identification	-	8	14	22
2: System Messages	-	1	-	1
3: Proceed	-	-	-	-
4: Term Entry*	15	2	1	3
5: Term Not in File	n/a	-	-	-
6: Term Selection	4	-	-	-
7: XRF, etc.	n/a	-	-	-
8: Modification	-	2	-	2
9: Logic	-	1	-	1
Made No Significant Mechanical Error	-	3	-	3
Strictly Thesaural Error	-	2	-	2
Did Not Participate in NYTIB Search	n/a	-	1	1

* Term entry is the first NYTIB screen shown in the tutorial session

Table 5.7

Last Step Successfully Completed on The New York Times Information Bank

Screen	Number of Cases (tutorial group)	Number of Cases (non-tutorial group)	Total
Did Not Complete Any Step Successfully	-	2	2
1: Identification	1	3	4
2: System Messages	-	-	-
3: Proceed	1	1	2
4: Term Entry	-	-	-
5: Term Not in File	-	-	-
6: Term Selection	2	3	5
7: XRF, etc.	-	-	-
8: Modification	1	-	1
9: Logic	4	2	6
10: Viewing Abstracts	10	5	15
Total	19	16	35

Table 5.8

Total Number of Significant Errors Made During the Tutorial Session

Number of Errors	Number of Participants
2	1
3	1
4	1
5	7
6	2
7	2
8	1
9	1
10 and over	3

Table 5.9

Total Number of Significant Errors Made During One Session on The NYTIB

Number of Errors	Number of Cases (tutorial group)	Number of Cases (non-tutorial group)	Total
0	5	-	5
1	5	1	6
2	3	1	4
3	2	3	5
4	1	1	2
6	1	-	1
7	1	2	3
8	-	2	2
11 and Over	1	5	6
Participant did not wish to conduct a search on NYTIB	-	1	1

CHAPTER VI

THE FORMAL EXPERIMENT: ANALYSIS OF DATA

The feasibility of conducting an experiment to test the effectiveness of the CAI program as a teaching tool for The New York Times Information Bank was confirmed in a preliminary study using thirty-five subjects from the Graduate School of Library and Information Sciences. In order to establish the grounds for generalizability of the findings, it was decided to open the experiment to the academic community at large, and request that each participant bring with him a question of genuine interest or use to himself. Also, to further differentiate between the thesaural problems encountered by a novice user and the mechanics of conducting a search, the formal experiment was divided into two sections. Design of the experiment for Section I closely followed that of the feasibility study, except that each participant was assisted in the off-line term selection process. Section II was given no human assistance beyond the general introduction to the keyboard and equipment and the logging in and out of the tutorial program.

A total of 75 appointments were made, eleven of which were subsequently cancelled or eliminated from the final analysis. The first forty cases comprised Section I and the remaining cases formed Section II of the formal experiment. Because of the conduct of the experiment in two sections and the variation in treatment of the subjects in Section I and II, the results will be analyzed separately. On the other hand it must be noted that such variations did not affect the underlying concept or the basic structure of the design.

The similarity in results among the members of the feasibility study, Sections I and II was confirmed by a Chi-square distribution equalling 1.673 at a .05 level of significance for two degrees of freedom. Furthermore, a contingency coefficient of the Chi-square ($C\sqrt{\frac{x2}{n+x2}}$) showing a .17 variation among the three sections also verifies the internal stability in the results obtained from each section.

The formal experiment was designed on the basis of the findings of the feasibility study. Individual groups were to be kept small enough to allow for personalized and extended record-keeping on the behavioral as well as physical reactions of each participant before, during, and after a search. Such records, by their nature, tend to contain many subjective factors. The intent of the following analysis is to explore such factors and use the data gathered only as a tool to delve into the qualitative characteristics of a first-time search on The New York Times Information Bank.

Section I

The forty participants in this part of the experiment were evenly divided between the tutorial and non-tutorial groups. Table 6.1 shows the obvious similarity in the background and makeup of the two groups. The only slight variation seems to be in the participants' previous experience with the computer. As with the feasibility study, the random assignment of individuals placed a larger number of those with a computer background in the non-tutorial group. However, this difference of four out of forty proved insignificant in terms of the final search results.

The time spent by the non-tutorial group in reading printed instructions was obtained for both sections of the formal experiment. Table 6.2 shows that the majority of the non-tutorial group spent less than sixteen

minutes in reading the printed instructions, and that no one spent over thirty-five minutes on this task. The tutorial group, on the other hand, averaged about thirty-two minutes in completing the CAI session. Observing the combined figures for both groups reveals that thirty-three out of forty participants felt ready to start an on-line search with less than thirty-six minutes of preparation time.

Regardless of the instructional medium used during the training period, no participant spent more than thirty minutes on The New York Times Information Bank, with an average of about ten minutes per search (see table 6.3).

Although the typical participant from the non-tutorial group was referring to the printed User Guide while conducting the on-line search, it is interesting to note that on the average he spent three minutes less than his counterpart from the tutorial group working with the Information Bank. Of course, table 6.7 reveals that over half of the non-tutorial group did not go beyond the term selection stage, which may explain the shorter time spent at the terminal. Table 6.4 also suggests that the time spent at the terminal by the non-tutorial group was not as fruitful as that of the tutorial group. While eleven participants (or over half) of the tutorial group succeeded in retrieving the desired results from the Information Bank, only three out of twenty individuals relying solely upon written instructions were able to achieve the same results.

Participants in both groups displayed symptoms of conceptual confusion as well as instructional misinterpretation. Although all participants in Section I of the experiment had been guided in their term selection processes, four individuals still showed dominant thesaural problems. One simply claimed that thesaurus terms were "ambiguous," another mistook the "geo" modification for the geography of the nation he was interested in, and a third picked a

duplicate file (indexing error) of an acceptable index term with only a handful of citations. The fourth case involved a shift from the participant's original question on "photography" to one dealing specifically with "Kirlian photography." Much of this individual's time was spent in searching the thesaurus for a file dealing specifically with this topic.

The conceptual problems faced by the participants varied widely, with most instances identified in chapter 5 being represented. Again we find that misinterpretation of instructional messages was present in varying degrees. Twenty-seven of the forty cases displayed various symptoms related to this problem, with eighteen individuals expressing hardship in interpreting the phrase "view continuation" or distinguishing between the A and B options in term selection and logic stages.

In comparing the data from tables 6.6 and 6.9 with similar figures from the feasibility study (tables 5.6 and 5.9), we find an obvious change in the reduced number of errors on the Information Bank. Three reasons may be cited to explain this phenomenon. First is the change in the setup of the formal experiment. The unusually high incidence of errors at the identification stage occuring during the feasibility study led to a permanent addition of a sign to the CRT unit. Placed directly above the top left corner of the screen, this sign informs all potential users of the system that they must use the University of Pittsburgh identification number, and explains <u>how</u> this number is to be typed and reminds the user to press the "enter" key. While in the feasibility group twenty-two of the thirty-five participants erred at this stage, this number was drastically cut down to only eight out of forty cases for Section I of the formal experiment.

A change in the design of the experiment was also responsible for the lower rate of errors. Section I had the benefit of discussing the selection of appropriate terms for each inquiry before the on-line session at the Information Bank was begun. This procedure eliminated much of the trial and error process by which the participants in the feasibility study managed to select terms from the on-line thesaurus.

A more significant reason for the reduced number of errors was the general attitude of the experimental group. Acting more like the general user population of The New York Times Information Bank than an "experimental" group, the participants displayed all the typical characteristics of the individual with a real information need. They were interested in the end-result of the search and not curious about the "machine" beyond the level of necessity required by the task. This meant that their tolerance level for receiving error messages and confusing instructions was relatively closer to the normal user population, resulting in their "giving up" without too many false attempts at interpreting system messages. Participants in Section I made an average of 1.7 errors per search and the highest number of errors in any search was five. On the other hand the participants in the feasibility study averaged a minimum of 4.2 errors per search with six cases making over eleven errors. (see table 5.9).

As may be expected, there was little variation between the performance of the participants in Section I and the feasibility group on the CAI program. Each showed an average of about six errors per session.

On the whole, participants in Section I were the most successful in obtaining desired results. Fourteen out of forty successfully completed a search on the Information Bank. Of this fourteen, eleven had participated in

the CAI training session while three had used only printed instructions. This figure compares well with the success rate of nine out of thirty-five in the feasibility study, and five out of twenty-four for Section II of the experiment.

It may thus be concluded that the CAI session is most fruitful for teaching conceptual, mechanical and instructional characteristics of the Information Bank when it is combined with a live discussion on the term selection process. Findings related to Section II introduce a new perspective to this conclusion.

Section II

This was the smallest section of this experiment, consisting of twelve individuals in each of the tutorial and non-tutorial groups. Because of its particularly small sample size, it would be improper to draw generalizable conclusions from this data. However, upon further reflection, one cannot overlook the fact that the success rate for this section has shown a decline from those reported for Section I and the feasibility study. Table 6.20 provides the basis for such comparison. As noted earlier, the contingency coefficient of the Chi-square distribution has shown this difference to be statistically insignificant. That is, this decline may be attributed to chance alone. But in order to account for all differences in the conduct of the experiment we may wish to further explore the fact that individuals in this group received no assistance during their off-line term selection process. One may intuitively conclude from this observation that an overwhelming number of participants in Section II faced thesaural problems. Closer examination, however, reveals that only four of the twenty-four searches were aborted due to thesaural problems (see table 6.14). Excluding the five successful

searches, we find fifteen participants who "gave up" because of conceptual or instructional rather than thesaural problems.

An examination of the conceptual problems shows that four out of ten individuals were looking for a logical combination of their terms at the term selection stage. While the participants may have entered acceptable index terms into the system, thus displaying no evident thesaural problems, they were in fact unable to conceptualize the flow of steps involved in the search which could enable them to select their terms from the on-line display. However, participants in Section I also displayed the same level of misconception, where four of the eleven cases with conceptual problems faced the same dilemma.

Having established the comparability of the two sections in all respects but for the off-line term negotiation stage, we may conclude that there were other "hidden" values in such a stage. That is, the sheer human contact and interaction, and establishing rapport between the participant and the experimenter (who is in this case also the "authority") may have played a more significant role in conducting the search than merely providing assistance in term selection.

Participants in Section II came closest to doing a search in the absence of an attendant, yet the only spontaneous comments presented upon completion of a session referred to the quality of assistance offered by the attendant. Of course, this assistance was offered after the participant had completed an un-aided search and refers to the full explanations given during the parallel search. The significance of such comments is that it re-enforces the author's belief that individual users naturally identify with the "human" element of the system. It may be worthwhile to repeat this portion of the experiment (Section II) on a larger scale to establish the significance of

"human contact" as an essential criterion for conducting a successful first-time search on The New York Times Information Bank.

Characteristics of the Successful Search

A total of ninety-nine searches were conducted under experimental conditions between November, 1973, and April, 1974, in three separate groups. Although the experiments were designed to test certain specific aspects of conducting first-time searches on The New York Times Information Bank, the ultimate goal was the same in all cases: that of training the novice user to conduct a successful search. For the purpose of these experiments a "successful search" was defined as one which satisfied the user's immediate information needs. Except for the feasibility study which required the participant to find citations for a question chosen by the experimenter, the participant's judgement on the usefulness of the end result was taken as final. Because the questions posed during the formal experiment were supplied by the participant and were meant to satisfy his personal needs, there were a small number which did not match the "normal search" profile as defined in chapter 3. Although all questions were screened before an appointment was made for the experiment, many questions were subsequently revised as the participant began to conduct the actual on-line search. The small size of certain files prohibited the use of modification in some searches. Thus, even though some searches may not have "mechanically" fulfilled the requirements of the experiment, they were nonetheless successful in answering the user's question.

Of the ninety-nine searches completed during the course of these experiments, twenty-four were mechanically complete as well as yielding successful results. Twenty-three of these twenty-four searches were conducted by the participants in various tutorial groups. Four other cases where the modification

stage was bypassed but the search was successful were added to the previous twenty-four cases to make a complete record of all successful searches. Four of these twenty-eight cases are from non-tutorial groups. Table 6.19 shows the characteristics of a successful search and the success rate for each set of these characteristics. The success rate is defined as the ratio of successful cases bearing a particular characteristic to the total number in the experimental group sharing that characteristic.

In order to obtain the probability of success for the sample population at the .95 confidence level, standard error for the sample was calculated. The results show the probability of success (p) for the true population to be:

$$.20 < p < .37$$

That is, all rates of success falling within the boundaries of .20 and .37 are statistically insignificant and the differences may be attributed to chance. table 6.19 shows all but two of the user characteristics falling within these boundaries.

The only significant figure is the nearly six-fold success rate of the tutorial over the non-tutorial group. From a different perspective, we find that while the entire group had a 28% success rate (28 cases out of 99), those in the tutorial group displayed a 47% success rate. This confirms the study's hypothesis that a combination of the CAI program and printed instructions is a more effective training tool than the printed instructions used alone.

All other figures in table 6.19 fall within ± 0.1 of the group's success rate, showing little significance in the effect of other observed user characteristics on search results.

On the average, we find that the successful searcher spent between 16-30 minutes on the CAI session, and that his search on the Information Bank

took about 14 minutes. He has a 50% chance of misunderstanding some of the system messages. It is quite likely that these will be related to the "view continuation" phrase or the A/B options at the term selection and logic stages.

The successful first-time searcher makes an average of 1.4 significant errors per search. These errors may occur any time during the negotiation process, but he is able to correct them without any assistance from another individual. However, there is no indication that the successful searcher would have approached the terminal on his own and conducted a search in the absence of an attendant. Many users expressed their apprehension of dealing with a fully mechanized system without any human assistance within easy reach. Results of Section II of the experiment, where the participants had the least amount of human contact, seem to confirm this experience.

Table 6.1

Background Characteristics of Participants in Section I

Topic	Number in Tutorial Group	Number in Non-tutorial Group	Total
Sex:			
Male	14	15	29
Female	6	5	11
Last Degree Obtained:			
High School Diploma	8	7	15
Bachelor's	6	5	11
Master's	5	8	13
Ph.D.	1	-	1
Educational Background:			
Social Science/Humanities	17	17	34
Science	3	3	6
Previous Computer Experience:			
Any Contact (batch or on-line)	9	13	22
On-line (time-sharing)	8	12	20
Familiarity with The New York Times Printed Index	8	8	16
Number of Participants	20	20	40

Table 6.2

Section I: Total Time Spent in Preparing for an On-line Search (training period)

Number of Minutes	Number in Tutorial Group	Number in Non-tutorial Group
Less than 16 minutes	-	13
16-20	2	2
21-25	4	1
26-30	6	1
31-35	1	3
36-40	2	-
41-45	3	-
46 and Over	2	-

Table 6.3

Section I: Total Time Spent Searching The New York Times Information Bank

Number of Minutes	Number of Cases (tutorial group)	Number of Cases (non-tutorial group)	Total
0	1	1	2
1-5	-	5	5
6-10	11	8	19
11-15	3	4	7
16-20	3	1	4
21-25	1	1	2
26-30	1	-	1
Total	20	20	40

Table 6.4

Section I: Search Results

Observation	Number of Cases (tutorial group)	Number of Cases (non-tutorial group)	Total
"Mechanics" of Search Completed in Full	12	2	14
"Mechanics" of Search Completed With By-pass*	2	4	6
Search Fully Successful	11	3	14
Search Partially Successful	1	1	2
Any Difficulty With On-line Instructions' Interpretation	12	15	27

* By-passed modification or logic stage which was not essential for the question at hand

Table 6.5

Section I: Dominant Factor in Search Failures

Type of Problem	Number of Cases (tutorial group)	Number of Cases (non-tutorial group)	Total
Conceptual	3	8	11
Thesaural	1	3	4
Instructional Interpretation	3	5	8
No Dominant Problem	12	3	15
Participant Did Not Wish to Conduct a Search	1	1	2
Total	20	20	40

Table 6.6

Section I: First Significant Error Made in the Course of a Session, Including Those Which May Have Subsequently Been Corrected

NYTIB Screen	Number of Cases (tutorial group)	Number of Cases (non-tutorial group)	Total
1: Identification	1	7	8
2: System Messages	-	3	3
3: Proceed	-	-	-
4: Term Entry	2	3	5
5: Term Not in File	-	-	-
6: Term Selection	7	2	9
7: Cross Reference, etc.	1	-	1
8: Modification	3	-	3
9: Logic	1	1	2
Made No Significant Errors	4	3	7
Did Not Participate in Search	1	1	2
Total	20	20	40

Table 6.7

Section I: Last Step Successfully Completed on The New York Times Information Bank

NYTIB Screen	Number of Cases (tutorial group)	Number of Cases (non-tutorial group)	Total
No Step Successfully Completed	1	2	3
1: Identification	-	4	4
2: System Messages	-	1	1
3: Proceed	-	1	1
4: Term Entry	2	1	3
5: Term Not in File	-	1	1
6: Term Selection	-	1	1
7: Cross Reference, etc.	-	1	1
8: Modification	-	1	1
9: Logic	3	1	4
10: Viewing Abstracts	12	5	17
Total	20	20	40

Table 6.8

Section I: Total Number of Significant Errors Made During the Tutorial Session

Number of Errors	Number of Participants
1	1
2	2
3	1
4	2
5	1
6	6
7	1
9	1
10 and Over	4
Data Not Available	1
Total	20

Table 6.9

Section I: Total Number of Significant Errors Made During One Session on The New York Times Information Bank

Number of Errors	Number of Cases (tutorial group)	Number of Cases (non-tutorial group)	Total
No Significant Errors Made	4	4	8
1	8	3	11
2	2	6	8
3	1	4	5
4	4	1	5
5	-	1	1
Did Not Participate in Search	1	1	2
Total	20	20	40

Table 6.10

Background Characteristics of Participants in Section II

Topic	Number in Tutorial Group	Number in Non-tutorial Group	Total
Sex:			
Male	9	6	15
Female	3	6	9
Last Degree Obtained:			
High School Diploma	5	5	10
Bachelor's	6	3	9
Master's	1	4	5
Educational Background:			
Social Science/Humanities	10	11	21
Science	2	1	3
Previous Computer Experience:			
Any Contact (batch or on-line)	5	3	8
On-line (time-sharing)	4	2	6
Familiarity with The New York Times Printed Index	9	9	18
Number of Participants	12	12	24

Table 6.11

Section II: Total Time Spent in Preparing for an On-line Search (training period)

Number of Minutes	Number in Tutorial Group	Number in Non-tutorial Group
Less than 16 minutes	-	4
16-20	1	1
21-25	2	3
26-30	3	3
31-35	-	-
36-40	1	1
41-45	1	-
46 and Over	4	-

Table 6.12

Section II: Total Time Spent Searching The New York Times Information Bank

Number of Minutes	Number of Cases (tutorial group)	Number of Cases (non-tutorial group)	Total
1-5	3	6	9
6-10	3	3	6
11-15	2	3	5
16-20	3	-	3
31-35	1	-	1
Total	12	12	24

Table 6.13

Section II: Search Results

Observation	Number of Cases (tutorial group)	Number of Cases (non-tutorial group)	Total
"Mechanics" of Search Completed in Full	3	-	3
"Mechanics" of Search Completed With By-pass*	2	2	4
Search Fully Successful	4	1	5
Thesaurus Problems	2	3	5
Any Difficulty With On-line Instructions	4	9	13

* By-passed modification or logic stage which was not essential to the search

Table 6.14

Section II: Dominant Problems in Conducting a Search on the Information Bank

Type of Problem	Number of Cases (tutorial group)	Number of Cases (non-tutorial group)	Total
Conceptual	4	6	10
Thesaural	3	2	5
Instructional Interpretation	3	2	5
No Dominant Problem	2	1	3
Participant Did Not Attempt Independent Search	-	1	1
Cause of Search Failures:			
Thesaural	2	2	4
Non-thesaural	6	9	15

Table 6.15

Section II: First Significant Error Made in the Course of a Session, Including Those Which May Have Subsequently Been Corrected

NYTIB Screen	Number of Cases (tutorial group)	Number of Cases (non-tutorial group)	Total
1: Identification	-	8	8
2: System Messages	2	1	3
3: Proceed	1	-	1
4: Term Entry	2	-	2
5: Term Not in File	-	-	-
6: Term Selection	4	2	6
7: Cross Reference, etc.	-	-	-
8: Modification	-	-	-
9: Logic	1	1	2
Made No Significant Errors	2	-	2
Total	12	12	24

Table 6.16

Section II: Last Step Successfully Completed on The New York Times Information Bank

NYTIB Screen	Number of Cases (tutorial group)	Number of Cases (non-tutorial group)	Total
No Step Successfully Completed	-	3	3
1: Identification	1	2	3
2: System Messages	1	-	1
3: Proceed	-	-	-
4: Term Entry	3	2	5
5: Term Not in File	1	1	2
6: Term Selection	-	-	-
7: Cross Reference, etc.	-	-	-
8: Modification	1	1	2
9: Logic	-	2	2
10: Viewing Abstracts	5	1	6
Total	12	12	24

Table 6.17

Section II: Total Number of Significant Errors Made During the Tutorial Session

Number of Errors	Number of Participants
4	1
5	3
6	2
7	1
8	2
9	1
10 and Over	1
Data Not Available	1
Total	12

Table 6.18

Section II: Total Number of Significant Errors Made During One Session on The New York Times Information Bank

Number of Errors	Number of Cases (tutorial group)	Number of Cases (non-tutorial group)	Total
No Significant Errors Made	2	-	2
1	6	4	10
2	1	6	7
3	1	2	3
5	1	-	1
6	1	-	1
Total	12	12	24

Table 6.19

Success Rate for Individual Characteristics

Characteristics	(A) Group of Successful Searchers T=28	(B) Total Experimental Group T=29	(C) Success Rate A/B
Male	16	48	.33
Female	12	51	.23
Undergraduate	7	26	.27
Graduate	21	73	.29
Any Form of Computer Experience	13	38	.34
Specifically On-line Experience	11	30	.36
Familiarity With the Printed Index	17	48	.35
Used CAI Training	24	51	.47
Used Printed Instructions	4	48	.08

Table 6.20

Comparison of the Success Rates in Each of the Three Experimental Groups

Experiment	Number of Successful Cases	Total Number of Cases	Success Rate Tutorial	Success Rate Non-tutorial
Feasibility Study	9	35	0.47	0.0
Section I	14	40	0.55	0.15
Section II	5	24	0.33	0.08

CHAPTER VII

A COMMENTARY ON THE INSTRUCTIONAL MEDIA

The formal experiment was originally designed to test the effectiveness of the computer-assisted instruction in conjunction with the printed instructions against the printed instructions alone. But most participants preferred to stay with only one form of instruction throughout the experiment. Those who had taken the tutorial used the printout of that interaction instead of referring to the User Guide for assistance. In effect the experiment became a test of CAI versus the User Guide. The only common medium for the two groups was the "blue card"—a 4" by 9" card summarizing the stages of each search and explaining the universal options available on-line. This card which was distributed to all participants as an introduction to the system's operation was designed to complement the CAI program and appears in Appendix B.

The "blue card" performed a very small function in the actual training process and elicited few comments. There is no conclusive evidence that it either helped or hindered a participant's ability to conduct a search on The New York Times Information Bank. Because of the inconsequentiality of its role in training users, this piece of printed instruction will not receive further attention in this chapter. Following the natural division of the two groups, the remainder of the chapter will deal with the CAI program and the User Guide in separate sections.

I. The CAI Program for The New York Times Information Bank

During the feasibility study all interactions with the tutorial program were reviewed for obvious programming errors as well as key questions which elicited an unusual number of wrong responses. A typical interaction printout is included in Appendix B. The two major stages where users made their first incorrect response were earmarked for programming changes.

Although many individuals made their first error at the term entry stage (following the NYTIB formatting rules), most were able to correct that error on a second chance offered by the program. The next step—that of term selection from a thesaural display—was the most confusing step for all users.

Difficulties in term selection from the menu offered on the "screen" ranged from simple negligence in reading all options and explanations offered, to serious misinterpretation of instructions. It was obvious, however, that the explanations offered were not sufficient for most individuals. Thus, a "help" routine was added to this section, allowing users to get better acquainted with some of the system terminology.

Help routines for the term selection and logic stages were available to all participants in the formal experiment. Twelve out of twenty individuals in Section I, and five out of twelve in Section II referred to these options. There were those individuals, however, who did not ask for help even though they felt that the instructions were unclear and that they needed assistance in defining messages such as "view continuation" or "citation range." One such individual offered his reason for not asking for help: "I don't want to admit to the computer how dumb I am." Of course, this may be interpreted as reluctance on the part of the participant to admit his lack of understanding to the experimenter. Two participants insisted upon

keeping the printout of their interaction on the tutorial program. Others felt obligated to justify their incorrect responses by indicating that it was done on purpose to find out how the computer would react to unexpected responses. One participant was totally unable to grasp the concept of the program or the "flow" of steps involved, repeating the first correct response suggested by the program throughout the remainder of the session.

Many of the conceptual problems faced by users of the Information Bank, and discussed in chapter 5, were encountered during the tutorial session as well. Some felt that a review of the entire printout upon completion of the session was the best way for understanding the flow of steps and their interrelationships.

It is quite difficult to judge the effect of the CAI program on individual participants. Given a single individual, there is no feasible way to test his understanding of the Information Bank's system messages before and after the tutorial session. Once he has been exposed to the system, the residual effects will carry over and affect his performance on the tutorial as well as his subsequent performance on the Information Bank. By the same token, if he were to complete the CAI session before his first exposure to the Information Bank—as was the case in this experiment—it cannot be concluded that the tutorial session was the ONLY reason for his success or failure in conducting an actual search.

Taken as a group, however, it becomes obvious that those exposed to the CAI training session stand a better chance in successfully completing an unassisted search on the Information Bank. Results of the formal experiment show clearly that this success is not due to the participant's exposure to an on-line system alone. Those with previous experience with computers and on-line systems <u>unrelated</u> to The New York Times Information Bank showed no

significant advantage over those with no computer background. Thus, the significance of the tutorial program created for this particular system cannot be denied. However, there were many shortcomings inherent in the design of this training session.

The major deficiency of the program was its incapability to build up error histories for individual users. For example, in the case of the individual whose single response was unvaried throughout the entire session, the program was unable to detect this error and offer individualized assistance. Also, the program's error analysis worked within a limited range of user response and did not provide for all conceivable errors which may have been made at a given point.

Criticisms of the tutorial were offered on three levels: technical, structural, and intellectual. From a practical viewpoint suggestions were offered in expanding the scope of definitions and explanations of the system messages at various stages. Many of these suggestions have been incorporated in the updated version of the program. The revised program also reflects the changes which have taken place on the Information Bank system messages in recent months. These changes include the recognition of certain common technical errors made by users such as placing an unnecessary double slash (//) formatting symbol at the end of a command.

Being a simulation of the Information Bank, the tutorial was subjected to the same structural criticism directed toward the actual system. It has been stated that there is ambiguity in the flow of steps and that not enough explanation is offered on each "screen". It has been suggested that a synopsis of the contents of the program should appear at the beginning (as well as the end) of the session. Although such criticism is quite justified, it must

be noted that such additions would add to the total session time without increasing the user/system interaction. Because of this consideration, the summary is presented as a supplementary printed card (the "blue card") which is available to all users of the system.

Expansion of explanatory messages would also lessen the active role of the user in the program. In order to add to the interaction, the total time of each session would have to be expanded. Experience shows that the first-time user of the Information Bank cannot "comfortably" devote over thirty minutes of his time to the preparation/learning process before a search.

Most of the above suggestions were taken into consideration, however, in developing the second CAI program which deals strictly with the process of term selection and entry.

On an intellectual level, the major objection to the tutorial program was its very restricted search capabilities. The session was specifically designed to answer a "typical" question—comprised of two terms, a date modifier, and an AND logical connective. One user objected that he was being forced to view the question from the programmer's point of view; he later generalized his comment to all CAI activities. Many others showed through their choice of responses that they would have preferred to deviate from the question at hand and explore other options offered on the "screens". For example, many insisted upon selecting more than the two required terms, or the date modifier.

Thwarting the user's curiosity to explore other possibilities through this training session was noted as the most frequent objection raised by the participants in the experiment. But time limitations, both the author's and

the user's, was a crucial factor in determining the length and scope of a first-time orientation program for the Information Bank.

In analyzing the success rate of the tutorial group in the feasibility study, it was found that fourteen out of seventeen individuals who were able to complete the term selection stage on the Information Bank went on to complete the "mechanics" of a search. Looking at the group as a whole, this statement holds true for 21 or 27 cases completing the term selection process. This as well as other evidence points toward term selection as being a major hurdle in the search negotiation process. Steps were taken to isolate common mistakes made by first-time users leading to failure in term selection. A second CAI program has been written to deal with these mistakes and to give hints on selecting terms off-line, procedures for entering these terms into the system, and finally selecting the correct files from the on-line thesaurus. A typical sample interaction is included in Appendix B. Although this "drill-and-practice" program has not been tested in a controlled environment, the user response so far indicates that it is a useful addition to the training process.

The CAI program sets a slower pace than the Information Bank itself. It corrects certain errors and offers explanatory messages for various steps of the search. It helps the novice user get acquainted with an on-line system on a one-to-one basis, yet poses less of a threat than the Information Bank. This is especially true for cost-conscious individuals who become over-anxious about the communication costs between Pittsburgh and New York. However, despite the advantages of the CAI program and its obvious benefits for at least half of the user group, it is the author's strong feeling that all users cannot be, and should not be subjected to the same training program. Some individuals may benefit more from traditional training methods. Familiarity with

the instructional medium establishes the common grounds necessary to start the learning process and removes some of the basic threats which a computer program may pose to the uninitiated user.

II. Printed Instructions

Three forms of printed instructions for the Information Bank were available at the time of the experiment. Additions and changes have been made since March of 1974, and the author has been informed that a new guide is under preparation. However, as of October, 1974, these three basic tools are still being used at the Information Bank. One is a comprehensive loose-leaf guide of over 300 pages which, though suitable as a reference tool, is rather cumbersome to utilize by the casual user of the system. There is a shorter (32 page) User Guide which was used as the main medium of instruction for the control group of the experiment. An even shorter guide (12 pages) entitled User Guide; helpful hints about the inquiry process, which is a companion to the User Guide, was also placed at the disposal of the participants in the feasibility group. It was subsequently removed from the formal experiment because of the poor reception it received during the preliminary study. It seems that this abbreviated guide is too short to provide all necessary information for a first-time search, yet too long and monotonous to capture the attention of those who have already scanned through the other User Guide.

Thus, the commentary on printed instructions accompanying The New York Times Information Bank is limited to the 32-page version of the User Guide. This guide is reproduced in full as Appendix A of this study.

The advantages of using some form of printed instruction in an on-line system were discussed in chapter 2. As a summary of that discussion, the most favorable points for the use of this medium may be listed as the familiarity

of the user with this form of instruction; and its permanence, portability, and independence from external conditions. That is, the user is able to carry a manual with him to study it at his leisure. He is able to refer to it over and over again. His preliminary use of the guide—to learn about the system—is not dependent upon the availability of the system itself. It will also cost less to obtain and read a manual than to operate a CAI program.

Other advantages of a user guide for an on-line system include the capability of using the instructions in conjunction with the system as opposed to the sequential use of a separate CAI program. A printed guide can go into more detail than CAI; it is also more suitable as a medium of instruction for those who feel uncomfortable with computers.

Yet we find a number of shortcomings in the use of printed instructions as well. Generally speaking, people do not read instructions very carefully; they do not take the time to read every detail. Transfer of information from printed form to action is rather difficult for many individuals. We also face the added disadvantage that the concept of interaction with a computer cannot be fully relayed to a novice user via the printed medium. Such points have been discussed in greater detail in the survey of literature, chapter 2.

On a more specific level, comments offered by all participants in the three experimental groups have been categorized and will be presented along with certain suggestions for improving the format and contents of the User Guide.

A. General Layout

The reader is referred to Appendix A for the format of the User Guide in question. It is noted that page one of the guide is very important but rather misleading to the non-specialist user of the terminal. He may feel,

and justifiably so, that he is not "familiar with the essential features of the Information Bank;" at which point he is left with the message that he must read everything in the manual. This means that he must read eight pages of information, including the mechanics and maintenance of the printer, before getting to a sample search on the Information Bank starting on page 10.

Experience with the feasibility group showed that by the time the user had read the first few pages of the Guide, he had totally lost interest or patience with this procedure. In many cases he had not even reached page 10 before he decided to try a search on the terminal. Because of this reaction, the participants in the formal experiment were guided to page 10 "A Basic Information Bank Search" with the aid of a paper clip and a brief prompting by the experimenter on the general layout of the User Guide. The results of this procedural change are quite evident by the rise in the success rate of the non-tutorial group in the formal experiment.

In a recent communication with the Information Bank staff, the author was informed that the new User Guide will no longer include information on hardware description and maintenance procedures. Because of the variety of terminals introduced in remote locations, a separate manual will be produced to deal with the idiosyncrasies of individual terminals and printers.

B. "The Simple Search" and "What You Were Doing and Why"

It was suggested by a number of users that they would have had a much better understanding of the simple search if the reasons for their response were identified either before or during the search rather than after (see pp. 10-14 of the User Guide).

If the present layout of the manual were to be changed to accommodate a column reserved for explanation of suggested responses, thus interjecting comments made on page 14 into the previous four pages, this problem may be resolved.

C. "Do This First"

This heading refers to a sample search portrayed in the User Guide (pages 10-12). As this was the most-used portion of the manual, it elicited the greatest number of comments by the users.

1. System messages as well as user responses are printed in green to simulate the Information Bank "screen." Many individuals do not differentiate between the two and assume that all material printed in green refers to system messages. This triggers the most frequently heard complaint about the sample search: "Why are the instructions printed backwards (or upside down)?!" This question refers to the ambiguity encountered when matching system messages with their corresponding suggested responses. For a clearer understanding of this error a portion of these instructions have been reproduced in Figure 7.1. The University of Pittsburgh identification number does not require a password; thus, screen instructions skip from #1 to #3. The user looks at this screen and looks for a matching message in the User Guide. He keeps reading on; assuming that Instruction #4 refers to System Message #3. The majority of users look at the system message and read down rather than up to find the suggested response. When the User Guide states "The next step will look like this," the user naturally looks for the closest message to the sentence. By doing so, he is in fact looking at the prior system message. Wherever this error occurs, the stage is set for the user to be one step ahead of the system message on-line. Users who depend upon the Guide for instructions tend to

Do this first

Step I–Sign-on

- When you see this message type in your identification number then PRESS THE ENTER KEY

Instruction #1

```
Terminal open
ENTER A//identification
£a//12345678
```

System Message #1
Response #1

- Next type in your password (if you are at a terminal which asks for this second sign-on step) AND PRESS ENTER

Instruction #2

```
Your password is required at this terminal
ENTER  A//password
£a//infobank
```

System Message #2
Response #2

- The next step will look like this. Type: b to select the spelled-out system message and PRESS ENTER

Instruction #3

```
Use abbreviated forms of system messages-A
Use full forms of system messages-B
£b
```

System Message #3
Response #3

- At this point you will see a message from the system monitor, usually a list of data base contents. Type: a to proceed and PRESS ENTER

Instruction #4

```
DATA BASE CONTAINS  NOV 1-15 1969,1970,1971,1972-DEC 15, AND S
E NON-TIMES MATERIAL  FULL TEXT AVAIL  SYSTEM MONITOR AVAIL
 If you wish to
A  Proceed: ENTER  A
B  Send message to System Monitor before proceeding, ENTER  B
£a
```

System Message #4
Response #4

c 1973
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Figure 7.1
A portion of a "Basic Search" as it appears in the Information Bank User Guide

to follow the printed instructions rather than the ones they receive on-line. They go so far as to enter commands which do not even appear on-line simply because they are following the wrong set of instructions from the User Guide.

Many users do not realize that the characters printed after the pound sign (£) are what they should be typing in response to a message. Some have suggested the use of an arrow or some other form of visual clue to show the user what he will be typing at every step.

The example used in the search has also proved confusing to some. Since the same term (Wankel) has been used with three separate meanings, it nurtures the thought that various concepts in the user's mind can be linked together at the term entry and term selection stages. Some novice users lose sight of the "alphabetic" nearness of the terms used in the example and expect to see all of their own input appear together on the screen of the Information Bank terminal.

D. Additional Suggestions

It may prove useful to link each step of the "Sample Search" to its corresponding section in the comprehensive User Guide by a page reference number. This would allow the user needing more detailed information to go directly to the step in question in the larger manual.

Since the modification stage is skipped in the simple search, the user needing to modify an inquiry should be referred (by a page number) to the section where modification procedures are explained (p. 18). Such simple referencing procedures may save the user much time and effort in paging through the guides for a single direction.

It is also suggested that at least the major universal options of "X" and "Z" be explained to the user as a part of the basic search.

Even though the User Guide in question is only 32 pages long, it is very much in need of a thorough index for easy referral to any portion of its contents.

CHAPTER VIII

THE NEW YORK TIMES INFORMATION BANK USER/SYSTEM INTERFACE

Apart from the quantitative findings of the experiment, this study yielded extensive qualitative results, especially in the area of protocol analysis. In fact, the subjective analysis of user reactions to the system in general, and specific stages of a search in particular, provides a rich source of commentary on the effectiveness of system messages in guiding a first-time user through a successful search. Such comments, of necessity, reflect the reactions of the academic community to the Information Bank. Although much of the discussion in the ensuing pages may be generalized to other user groups, some comments specifically reflect the thought processes of the student population.

In his recent analysis of eleven interactive retrieval systems Thomas Martin notes "It rapidly became clear that designers knew little about the habits and characteristics of individual users. . . .Only gross generalizations were available regarding whether end users were carrying out their own searches." (1) The Information Bank is no exception in this respect. A 1973 article by John Rothman, Director of Information Services of The New York Times, seems to identify the newspaper reporter and staff as the major user population:

> The messages that form the computer's part of this dialogue are in terse but conversational, non-technical English. These messages and the diverse options and instructions that they present were designed with the newspaper reporter and editor in mind. Emphasis mine (2)

This is a very fair and justifiable statement and certainly seems to give the designer a specific lead on the ultimate user population of his system. However, in a more recent communication, Dr. Rothman clarifies the above statement as follows:

> This [that the system was "designed with the newspaper reporter and editor in mind"] is misleading as stated. The system was intended from the very beginning to serve a variety of outside users—business, government, educational institutions, and the like—as well as our newsmen; however, the vocabulary and the specifics of the inquiry process are based largely on what we knew and learned from the uses of The Times Index and Morgue. We were very well aware of the fact that our user population would include a large number of casual and transient users who would often be in a hurry and many of whom would be unskilled in research techniques and unfamiliar with interactive computerized retrieval systems. (3)

It is quite justifiable, and in fact desireable, to design and build a system with a specific user population in mind. However, it is a more difficult task to broaden the scope of the market for a bibliographic information retrieval system to a point where the end users may have conflicting, or at least unrelated, information needs. Although it is obvious that a broad segment of the population reads the daily newspaper, there is no evidence to show that all readers peruse this medium in the same manner or for the same purpose. Indeed, it would be contrary to common sense to claim such a thing. By the same token it cannot be reasonably expected that an abstracted version of the news, made available through a single controlled vocabulary and common commands can answer the needs of such a varied population. While the journalist may find easy access to the files through personal or organization names, the academician may prefer a finer breakdown of the news by subject. While an editor may be looking for clear facts, the student is still groping for ideological or philosophical concepts related to world affairs. When we discover that it is virtually impossible to track down certain newspaper articles

dealing with a concept undefineable through the thesaurus, it becomes questionable that the designers of the system had fully identified the ultimate user population. In describing the aforementioned report by Martin, he states:

> Missing from what follows is a clear picture of the users, how frequently they search, and the problems they run into. System representatives were asked to characterize their users but few could do so. (4)

Taking this juxtaposition a step further, Dr. Rothman believes the Information Bank to be "largely self-teaching and self-service" and asserts that "the interposition of librarians or information specialists is not required." (5) Assuming the usability of the Information Bank by a "variety of outside users," accepting the self-teaching capabilities of the system, and limiting the discussion to the academic community, the system interface will be analyzed on three levels.

First, some general comments will be made regarding the feature or commands which apply to more than one individual "screen" or step. Next, there will be a screen-by-screen analysis of instructional messages as well as some conceptual problems faced by users at specific steps. Finally, there will be an overview of the system as it compares to "minimal design features" recommended by the eleven system designers participating in the Stanford Workshop. At each level of analysis the author will also present certain recommendations based upon user comments offered in the course of the past two years, as well as results of the experiment and the overall experience gained in training novice users of the system. All three levels of analysis are arranged, whenever possible, to follow the flow of a complete search strategy; only the full form of systems messages (recommended for the novice user) has been taken into consideration.

A final note on the ensuing recommendations: most changes may be implemented with a minimum of re-programming and cost. However, at first glance, some of these changes may seem upsetting to the present users of the system who have "memorized" all options and commands. On the other hand, keeping the expanding user population in mind, the longer such changes are put off, the harder they will be to implement as the number of users wishing to keep the status quo grows. In looking back at some of the changes which have been made since November of 1972, we can easily see the long-range positive effects far outweigh some of the immediate hardship involved.

In cases where major additions or changes are recommended, it is done so with the understanding that such revision may not be feasible in the near future. However, the author feels it is important to bring to light those features which are needed to make the system more responsive to human needs. These user-oriented principles "will not be backed up with citations to a well-developed body of man-computer problem-solving literature because that body of evidence has not yet been created." (6)

I. General Comments

Most designers of on-line systems consider a user manual and live instructions as essential elements of a system. This fact was brought to light during the Stanford Workshop, but Martin adds "One should not conclude, however, that on-line documentation and assistance are unimportant." (7) This author contends that supplementary on-line instruction is absolutely essential when a transient user population is expected.

On-line instructions can be kept up-to-date while printing and distributing new manuals may be more time consuming and costly. If printing costs are to be cut down by revising certain pages of the manual, it is difficult to

monitor all remote stations and make sure such revisions are recorded properly. A survey by the National Library of Medicine showed that the user manuals were not kept up-to-date or actively used by the subscribers. In many instances such manuals were not even kept close to the terminal location. (8) Such problems could be avoided by keeping a fully updated version of all system instructions on-line.

However, it is not enough to convert the printed user guide into machine readable form and provide a simple index to the text. Time and time again it has been shown that "users learn by doing." (9) It is a pity that the majority of present day on-line systems do not take advantage of their interactive capabilities to communicate the essence of an interactive search to the novice user. Even where instructional texts are available on-line (such as MEDLINE) little attempt is made to test the user's understanding of what he has just read. Interaction, even at its simplest level of drill-and-practice, can be a great boon to the first time user of the system.

Informative notes, apart from a complete tutorial, may be a first step toward creating a total system which would be truly user-oriented, allowing for full interaction without the "interposition of librarians or information specialists." The next section will address some of these needs as applied to specific instructional messages of a particular screen. The following recommendations apply to the system in general or at least refer to topics related to two or more screens.

1. Immediately upon "sign-on" the user should be given the option to view "explanatory notes." Such a step, in the future, may lead the user to an on-line tutorial program. For the present, it can perform the following functions:

A. Upon specific demand, show the user a list of "new terms" added to the file. Based upon file maintenance procedures, this list may be changed weekly, bi-weekly, or monthly. In any case, this would be of great advantage to the novice and well as the experienced user. New terms are constantly added to the file, but they are immediately lost to the alphabetic order of a very large thesaurus.

It was announced in November 1972 that a new index term has been added to the file. "New search terms" is a most recent addition to the thesaurus which answers the basic need mentioned above. However, as is presently implemented, the perusal of such a list requires the user to complete a full search and view these new terms as he would the abstracts to articles; i.e., as the final output. For those subscribers who are being charged on the basis of connect-time this feature implies the payment for a full search just to find out what terms are "searchable." This arrangement does not seem satisfactory to the author. New search terms should be listed in alphabetic order and the system should provide a means for selecting appropriate terms at once, at the beginning of the session.

B. Upon demand, give a more elaborate description of the current status of the data base than what appears on the third screen in the present format. A short description of non-Times sources would be particularly informative to the users.

C. Upon demand, describe the universal options of the system. These options which are in fact essential ingredients of a search

(such as the universal option to terminate a search) are presently lost in the verbiage of the User Guide. Their function is described on page 31 of the Guide in the glossary of terms. One wonders how a first-time user is expected to come upon this definition if he is not aware of the existence of "universal keys."

D. On a temporary basis, until such time that a tutorial is designed, it would be helpful to have a one-page (one screen) explanation of the flow of steps in a normal search. This may be similar to the "blue card" (Appendix B) designed to familiarize the participants in this study's experiment with the stages of an Information Bank search. As the results of the experiment confirmed, many novice users have difficulty conceptualizing the flow of search steps. It would be to the advantage of this group to get acquainted with the system through this suggested option.

Following the general format of instructional messages presently offered by the Information Bank, all above options may be presented in menu form. In order that such an additional step would not hinder the search process for the experienced user (who may not be looking for new term entries), the screen immediately after sign-on may be ammended as follows:

Use abbreviated forms of system messages = A.
Use full forms of system messages = B.
View explanatory notes (search steps, new terms, etc.) = C.

2. Revision and expansion of error messages. Most of the present error messages are of no value to the user beyond informing him that whatever response he had entered was unacceptable to the system. In the few cases where

explanations are offered--with the exception of date modification error messages--they prove to be more confusing than helpful. Error messages specific to a given screen will be discussed in their appropriate context in the next section. The following comments are applicable to more than one screen.

A. The system's universal error message is "INCORRECT RESPONSE TO MESSAGE. PLEASE RE-READ INSTRUCTIONS". The most helpful addition to this message would be to display the user response which triggered its display. That is, whenever an error message appears, the system must repeat the user's last response. Such a display would in itself solve many misunderstandings caused by the user's carelessness in spelling or typing. In the absence of such prompting, and when the user thinks that he had made the correct response, he may be forced to choose a wrong option because he has no access to his last response which might have given him a clue as to where he went wrong.

B. The overwhelming user difficulty in interpreting the phrase "view continuation" has been mentioned in previous chapters. It is a phrase used often throughout the instructional messages of the Information Bank. Here, in free from, are a representative sample of definitions offered by users for the phrase "view continuation":

"It means to go on and see the abstracts."

"Continue to look for my other terms."

"Continue to look at the list until I find the combination of my terms."

"Continue with my search."

In juxtaposition with the next option which always allows the user to "go to next step", some users felt that they must choose to "view continuation":

"But I haven't chosen all of my terms yet; I am not ready for the next step."

"I am not ready to look at the abstracts yet."

Thus we see that just as some users felt obliged to view the continuation because of misinterpreting its meaning, others chose this option by default, because they were misinterpreting the meaning of "go to next step". Add to these the numerous users who admitted total confusion ("I'm completely stuck, I have no idea what it means"), and we have the opinion of the majority of users on this topic.

Although the nature of this statement makes it impossible to monitor the motives of the user when he chooses to "view continuation", it would seem very reasonable to provide a minimum of guideline for those who are obviously misusing the option.

It is understood by the experienced user that whenever an "End of Display" sign appears at the end of a page, there is no continuation to that screen. It is suggested that this simple test be monitored by the system and whenever a user chooses an option which implies "view continuation" from a screen containing the "End of Display" message, the following error message be offered:

"There is no continuation to this screen. Choose another option."

Presently the system simply keeps repeating the same screen, offering no indication to the bewildered user as to what has caused such repetition.

Another means of lessening the user's confusion would be to clarify the phrase, perhaps by stating "view continuation of present list."

C. A universal error, especially applicable to experienced typists, is to use the lower case of the letter "ℓ" instead of the numeral "1". It is suggested that whenever the system is expecting numeric input only that a test be made to detect this error. It seems only reasonable to make allowances for this type of human error wherever possible.

D. At times, when an extra space is inserted in a response, a word such as "and" is typed between two term numbers at the term selection stage, or other similar mistakes are made, the error message reads:

"A VALUE ENTERED WAS NOT PRESENT IN THE LIST OF ITEMS DISPLAYED."

Many users unfamiliar with "computer language" are unable to extend the definition of "value" to non-numeric elements or characters. Thus, they are more confused than assisted by this message. Perhaps, if a more distinct message cannot be offered, it would be best to replace this with the standard error message of the system.

3. The universal key "W" provides an explanation of abbreviations used in the Information Bank. This option has great potentials which have not been exploited as yet. As it stands, the explanations offered are nothing more than the full spelling of the abbreviated items. It does not define purpose or procedures for using the abbreviations. In more cases than not, when the user types "W" he encounters the catch-all phrase "NO EXPLANATION MESSAGE AVAILABLE".

It is suggested that without going into a deep discussion of options or abbreviations, a short but uniform amount of explanation be offered for key terms and abbreviations appearing in all instructional messages. A very good example of an instruction requiring explanation for non-journalist users is the modification stage. Although details of problems will be discussed in the next section, it may be illustrated here that "sketch", "type of material", or "source" each have totally different meanings outside of journalistic circles.

4. In connection with the system error messages it was suggested that the last user response be repeated on the following screen. This is presently done only on the second page of the logic stage. It may be pointed out that such an option may be used for a variety of reasons, other than error detection, throughout the search. It basically "confirms" the user response and may be especially useful during modification and logic stages.

5. Current system programming and Incoterm hardware do not allow for a differentiation between a legitimate time delay and total system failure. In either case a light marked "system not available" comes on to denote that the user has lost contact with the computer. Also, many novice users do not associate the light on the keyboard marked "enter pending" with the fact that their latest response has been—or is being—relayed to the computer. Thus,

whenever an immediate response is not forthcoming, the user becomes very anxious and repeats pressing the "Enter" key and otherwise displaying his concern.

With the knowledge that The New York Times Information Bank is currently using a variety of hardware at its remote locations it is suggested that a programming addition be made to give verbal (printed) or visual clues to the user as to whether it is his turn or the computer's turn to work on the query.

The remaining suggestions are not "informative" to the user in the same sense as those offered above. Nevertheless they require careful consideration by the Information Bank staff as they affect the ease with which a user carries on a normal search.

6. In all cases where the first two options appearing on the screen are the same—except the first option allows viewing of continuation—it is suggested that the order of these options be reversed.

In the majority of normal searches the user does not need to view continuation. But we have already observed that most everyone reads instructional messages from top of the screen and stops reading as soon as he finds an option which seems to satisfy his basic needs. Thus, many users never reach the second option which is really best suited to their needs.

It is also very important to note that in many cases, such as term entry from the title abbreviation screen and many of the modification steps, the first option is currently unnecessary and cannot be used by anyone for any purpose. By appearing at the top of the screen, such options help no one and can only harm the first time user by making his search process more tedious.

7. In keeping with the overall uniformity of system messages and preserving a sense of identification with each option, it is suggested that at the point of viewing abstracts the "C" option be allowed to carry out its

established meaning of "view continuation." At present this option terminates the query at hand. Many users who have gone through the entire search associating the "C" option with "continuation" automatically type "C" when they wish to view the next page of abstracts, thus unintentionally terminating their search.

8. There is a definite need for a fail-safe step which would warn the user that his current search is about to be cancelled.

The universal option of "Z" terminates a search at any given point. It is not unusual for an individual to press this key by mistake, especially if he had intended to type "A" and his finger had slipped to the next row on the keyboard. Also, as mentioned in item number 7 above, the user may have typed "C" rather than "A" to view the continuation of abstracts. This action would lead him to the following message:

A. Begin another inquiry, ENTER: A
B. Terminate, ENTER: Z

For those unfamiliar with the universal option "X" which allows the user to go back to the previous major step (in this case the logic step), there seems to be no way of recovering the search they had unintentionally dropped.

It would seem fair to give all users a second chance to decide the fate of their current search. Instead of simply erasing all transactions as soon as the "Z" option is requested, the system might "hold" the query for further verification of the termination request. In cases where pressing the "Z" key has been unintentional, such a fail-safe step can save much time and effort without unduly affecting normal search processes.

II. Screen-by-screen Analysis of the Information Bank

A. Sign-on

Terminal Open
ENTER A//identification

The above message greets the novice user as he approaches the terminal. Although it looks self-explanatory, a majority of first-time users ignore the "A//" format. Most proceed to type the identification number without a format and are immediately confronted with an error message. But there are those who feel that they can enter their query at this point (defining identification as "identification of search terms!") It has been the experience of this author that in such cases the system response is very slow. Sometimes there is no response unless the screen is "reset" and the correct identification entered.

Returning to the group who entered the identification number without a format, they are now faced with the following error message:

INCORRECT RESPONSE TO MESSAGE. PLEASE RE-READ INSTRUCTIONS
QUIT = A

ELAPSED TIME = 0 MINUTES

Of over thirty participants in the experiment confronted with this screen, only one was able to correctly interpret this message and return to the identification entry step. Some of the representative comments about this error message are as follows:

"How can I re-read instructions if there are none offered?"

"How can I quit if I haven't even started?"

"Does Quit = A mean that I should quit using "A"?"

One participant interpreted this message to mean that an identification number was not required (since he had typed it and it was rejected) and proceeded to enter his query terms. Another participant, after making the same formatting error on three occasions and being told to "follow the instructions literally" proceeded to type:

A//identification

instead of entering the identification number.

The results of this experience were discussed with the Director of Information Services of The New York Times. It was stated that this step has been made intentionally difficult to discourage unauthorized use of the system. But it must be assumed that only authorized individuals have access to the actual identification number and password (which is required at some locations). There is also no question of privacy or security involved in this data base as far as subscribers are concerned. In addition, there is no danger of input or file manipulation from remote locations using subscriber identification numbers. As a final point, we will see that a more reasonable error message is already available to those who type the correct format but the wrong identification number. Since it is the identification number and not the format which distinguishes "authorized" from "unauthorized" users, it seems rather harsh to punish the novice user for forgetting to follow the acceptable format by denying him access to the instructional message at the point of sign-on.

If the user had typed the correct format but the wrong identification--which is just as likely to happen to an unauthorized user--he would be given the following error message:

```
IDENTIFICATION ENTERED IS UNKNOWN TO THE SYSTEM
CORRECT IDENTIFICATION REQUIRED.  ENTER A//IDENTIFICATION
```

This message is repeated twice before the user is referred to his instructor for assistance. This error message seems more reasonable and it is suggested that it be used for all user errors at the identification stage.

B. System Messages

Use abbreviated forms of system messages = A.
Use full forms of system messages = B.

In a normal search--barring mistakes made during identification entry--this is the second screen the user encounters. For the novice user who needs full instructions, this is the only screen with a totally different format. If the same instructions were to be re-written to match all other screens in the "full forms" format, this is the way it would look:

If you wish to:

A. Use abbreviated forms of system messages, ENTER: A
B. Use full forms of system messages, ENTER: B

Instead, the present format conforms with the "abbreviated forms of system messages." Although the User Guide suggests that all punctuation marks in instructional messages be ignored, still many users are misled by such extra characters. It would be helpful to present this screen in the "full forms" version.

However, the important issue at this step is the content rather than the form. "System messages" has no meaning to most users unfamiliar with computer jargon. Here is a sample of personal interpretations of this message:

"If I want to abbreviate I use A; if I want to spell out my words I use B."

"I send my message here?"

After choosing the "A" option: "I just want to take a quick look at what they have."

Another reason for choosing the "A" option: "I thought it would be easier; I have a short search."

Others chose the "A" option simply because it appeared first on the screen.

It would be a simple task to replace the phrase "system messages" with more familiar terminology such as "instructional messages" or simply "instructions."

C. Messages From the Monitor (System Bulletin)

(Data base contents and other messages from the Monitor)
If you wish to:
A. Proceed, ENTER: A
B. Send message to System Monitor before proceeding, ENTER: B

The monitor messages change from day to day or even a number of times during a single day. The questions posed by the novice user at this point usually concern the monitor himself or the terminology he uses in his messages. For example, the meaning of "FTV" (full text viewing) or "deferred printing" are questioned. Those individuals anxious to begin the search process sometimes type the letter "A" to proceed and follow that by their search terms.

Generally, there is little problem encountered by the novice user at this step.

D. Term Entry

Enter (or add more) search terms.
A. Enter 1 or more search terms (separated by //),
ENTER: A//term//term//. . .etc.
B. View title abbreviations then enter search terms,
ENTER: B

By this time the user has become familiar with formatting procedures. In cases where the problem still occurs the user is able to detect the error and correct the format.

Based upon thesaural errors made during the term entry process, a short guide was developed to complement the second CAI session dealing with term entry and selection. This guide appears in Appendix B and may be referred to if the reader wishes to identify the major areas where novice users needed assistance in the term entry process. It would be beyond the scope of the present study to address such problems in detail.

Other than the conceptual problems involved in selecting appropriate index terms, the basic problem at this step was the "B" option. One user complained that since he had asked for the "full forms of system messages" he should not be getting "abbreviation" of titles.

The most common interpretation for "title abbreviations" is the abbreviation to titles of articles (rather than personal names). Since many existing bibliographic information retrieval systems contain an option to search by title of article or publication, the novice user extends such meaning to the Information Bank data base structure. His problem becomes more acute when he actually requests to "view title abbreviations." He is then confronted with the following list:

Enter (or add more) search terms.
A. Enter 1 or more terms and view continuation.
ENTER: A//term//term//. . .etc.
B. Enter 1 or more terms and go to next step.
ENTER: B//term//term//. . .etc.
C. View continuation, ENTER: C
D. Go to next step, ENTER: D

PRS MYR GOV SEN REP MRS VP SIR CLM ADR ADM AMP
ABP ADK ASM AAG ALI ADN ADI ADA APG ASC ASG ASU
. . . . . .
SP4 SP5 SP6 SP7 SP8 SP9 SBP SUP SPV SUG SUR IRS
USC USG USA VRV VAD VCH VCL VMA VMI VIS COS

** * *END OF DISPLAY* * **

If he is the typical first time user, he does not know about the "W" option to view the full form of such abbreviations. Thus, after a moment of staring at the list of abbreviations he tries to continue his search by disregarding it. He then proceeds to read his instructions from the top of the screen and chooses the "A" option to enter his terms. Upon pressing the "Enter" key, this screen repeats itself—the "End of Display" sign indicating that there is no continuation to this screen. Totally bewildered by this "magic" disappearance of his terms and the repetition of the same screen, the user now proceeds to re-enter the same terms. If he is curious, he may try the "B" option the second time; if not, he may use the "A" option again, switching over to "B" only after several tries fail to take him past this step. Meanwhile, the computer has been systematically saving all of the user's entries. After the command of "go to next step" is finally given through the "B" or the "D" option, <u>all</u> entries will be displayed to the user on a sequential basis. It is not difficult to imagine the user's concern and frustration when he must repeatedly decide to accept or reject the same term.

This is one of the cases mentioned earlier where the "A" option is of no value to the user (because of the "End of Display" sign) but causes much frustration by simply appearing first on the list of options available.

E. Term Not in File

This term is not in the file. If you wish to:
A. Enter replacement term, ENTER: A//term
B. View title abbreviations and enter replacement term, ENTER: B
C. Reject term, ENTER: C
D. Suggest this term be added to the file, ENTER: D
(term in question appears here)

There were many objections to this screen. Because the term was placed immediately after the "D" option, many users failed to notice it and then wondered which term the system was referring to. Some felt that all of their terms—or the one picked from a previous screen--had been rejected. There was no indication given as to why the term was not in the file or what would be done to rectify the problem. An early report to the Information Bank staff resulted in the subsequent changing of that screen to the following:

The term below is not in the file. Have you made a spelling or format error? If you wish to
A. Enter the term again spelled differently (or another term) ENTER: A//term
B. View title abbreviations and enter term, ENTER: B
C. Reject term, ENTER: C
D. Suggest this term be added to file, ENTER: D

(The term in question now appears here)

The present format solves all of the previous problems. But one more hurdle still exists. When the user finds that his term is not in the file he decides to view title abbreviations as a last resort. In two years of observing academic users of this system, the author has not encountered a single case where title abbreviations were used successfully by a non-

specialist user. As described earlier, "titles" are normally defined as "titles of articles" by the academic user. It may also be added that what the academic community really needs is a means of modifying a geographic location by a title, to find the name of the president or prime minister of a country or the name of the mayor of a city. If the user already knows the name, he has no need to modify by title. Most cases of doubts concerning the correct spelling of the name are rectified through means other than the use of title abbreviations.

F. Inversion of Terms

Try an inversion of this term.
A. Enter term with changed word order, ENTER: A//term
B. Reject term, ENTER: B

UNITED FEDERATION OF TEACHERS

The instructions on this screen are quite simple and straightforward. But two facts remain to be clarified:

1. How do you invert a complex term? In this case, is it "Teachers, United Federation of", or "Federation of teachers, United"? There are many more complex examples which may be cited.

2. The system seems to infer that the inverted form of the term in question is actually in the file. A user entering a complex term through a variety of inversions may finally realize that regardless of his form of input the system cannot accept his term.

It is suggested that the caption to this screen be modified as follows:

The inverted form of this term may be in the file.

The system should also offer a minimum amount of help by prompting the user to "be sure to enter a space after the comma," as this is a common cause for rejection of inverted terms.

G. Term Selection From a Menu

If you wish to:
A. Pick term(s) by number from list below and view continuation
ENTER: A//term number//term number. . .etc.
B. Pick term(s) by number from list below and go to next step.
ENTER: B//term number//term number. . .etc.
C. View continuation. ENTER: C
D. View information (XRF: notes, cross refs) about 1 term
Enter: D//term number
E. Go to the next step. ENTER: E
1 AUTOMOBILES
SUB XRF 8192-16383/C
2 AUTOMOBILES SALES AND SALESMEN
SUB 1/C

** * *END OF DISPLAY* * **

Certain general comments are in order before examining individual option problems.

1. It has been observed that many students analyze this screen as though it represents an "outline". From their point of view all numeric divisions fall under the alphabetic division of "E". Thus, they are convinced that numbers must be picked in relation to the letter "E". Many such individuals respond with "E//1//2, etc." or "B//E1" when they should be typing "B//1//2, etc."

2. Most individuals do not differentiate between "term number" and the "citation range."

In order to alleviate both the "outline" problem and the confusion related to term numbers, it is suggested that a heading be inserted above the columns representing term numbers and the citation range. So that the experienced user would not be deprived of receiving an extra term per screen (the line taken up by such a heading), headings may be attached to the full forms of system messages only.

On a more specific level, the following observations are noteworthy:

1. The "view continuation" as well as the "A" vs. "B" problems are quite obvious at this stage. Again, it is urged that an error message be offered if the user attempts to pick the "A" or the "C" option from a screen showing an "End of Display" sign. Also a slight modification of the phrase "view continuation"—would help the user who may be confused about the meaning of the option.

2. Most novice users of the system do not understand the significance of the "XRF" (Cross-reference) attached to a thesaurus term. These individuals request to "view information" about a term not tagged with "XRF", using the "D" option. The error message at this point informs the user:

THIS TERM HAS NO NOTES OR CROSS-REFERENCES

It is strongly recommended that the wording of this error message be made positive and more informative. For example:

INFORMATION IS AVAILABLE FOR TERMS TAGGED WITH XRF ONLY

3. In reference to the citation range, it must be noted that the majority of users do not become aware of its significance on the first search unless it is brought to their attention by a human assistant. If these figures were identified by a heading, as suggested above, this problem would be solved to a certain extent. It would also be much less confusing if instead of showing a binary range, which is unfamiliar to many, the actual number of postings were to be shown.

H. Accepting Terms

If you wish to:
A. Accept the term as given below, ENTER: A
B. Reject this term, ENTER: B
C. See more information about this term, ENTER: C
JEWELS AND JEWELRY
SUB XRF 256-511/C

Although this screen is by far easier to understand than the one discussed above, it still presents its own unique problems.

1. Unfortunately, the sample search presented in the User Guide does not explain this screen. Those who are depending entirely upon the instructions offered in the Guide see an unfamiliar screen for the first time at this point. The most normal reaction is to ask for "more information". By doing so, the user is faced with yet another unfamiliar screen. Many first-time users are unable to go beyond the cross-reference screen without human assistance.

2. The major problem with this screen is not so much instructional as it is conceptual. When a user has selected a term from the menu (G above) which contains an automatic cross-reference, he must again decide to accept or reject the term he has already picked after viewing the cross-reference screen.

Most novice users are simply confused as to why they must pick the same term twice. Some proceed to reject the term on the second round to avoid redundancy.

As an experienced user, the author is in full sympathy with the novice. It is frustrating enough to be subjected to an automatic cross-reference which is usually of no assistance, but to have to reconsider the acceptance of a term already chosen is indeed unjustified. Of course, the author understands the significance of such a step in warning the user of certain scope limitations of the term he has chosen, or familiarizing him with related terms. But in every case where the user needed such information or explanation the chances are quite high that he had already taken advantage of the "D" option to look at the cross-reference before selecting the term. This means that the conscientious user is in fact forced to look twice at the cross-reference (once before, and automatically once after term selection) as well as having to select his term twice (once from the menu and a second time after he has viewed the automatic cross-reference,) thus going through four steps just to pick a single term. This is indeed a high price to pay in order to avoid having an "unwanted" term at the logic stage.

It is an established fact that all terms chosen by a user are displayed at the logic stage. Assuming that an "unwanted" term appears at that stage, it can easily be ignored and it can do absolutely no harm to either the user or the system.

It must be noted that there is a "precision" key which allows the user who knows he is asking for a legal index term to skip the thesaural display stage. However, even this shortcut is not immune from the two extra steps of viewing an automatic cross-reference and re-accepting the term entered with the precision character.

I. Cross-reference

If you wish to:
A. Pick term(s) by number from list below and view continuation.
ENTER: A//term number//term number. . .etc.
B. Pick term(s) by number from list below and go to next step.
ENTER: B//term number//term number. . .etc.
C. View continuation, ENTER: C
D. Go to the next step, ENTER: D

ACCIDENTS AND SAFETY
SUB 1969-1969 XRF 1024-2047/C
NTE In regard to means of transportation, material on
NTE delays, whether or not due to accidents, is
NTE included.

1	*SAL NT SUB*	*ASPHYXIATION AND SUFFOCATION*
2	*SAL NT SUB*	*BURNS*
. . . . .		
10	*SAL RT SUB*	*LIFE-SAVING EQUIPMENT*
11	*SAL RT SUB*	*LIFEBOATS AND LIFERAFTS*
12	*SAL NT SUB*	*LIFEGUARDS*
	SAÓ	*accident victim names*
	SAÓ	*personal names*
	SAÓ	*sport names*

** * *END OF DISPLAY* * **

As an extension of the above discussion on automatic cross-references, another feature of the Information Bank must be noted. When there is a single synonym for a term in the thesaurus there is an automatic switch from the form entered by the user to the legal version. For example, if a user were to enter the term "youth", the system would automatically switch to the accepted file of "children and youth".

The normal procedure for automatic switching is such that the user does not become aware of it until he reaches the logic stage. Of course, if the user is doing a search requiring only one index term, he will never see the term the system has picked for him. Since switching also takes place from a narrow to a

broad term, the user may be surprised to find that by entering a single narrow term (such as "hours of labor") he may "exceed the system limit," because his inquiry is switched to the general file on "labor".

As the Information Bank has been adding to its automatic switches and cross-references, the unassisted user has had to face the confusion without any aid from the system. It seems only fair to emphasize the existence of such features to the novice user either through on-line instructional aids or easily accessible written guidelines.

From an instructional standpoint, a sample cross-reference screen reveals the following problems:

1. Many abbreviations are used which are not explained on-line, promoting the mystique of "computerese." The most common comment at the cross-reference step is "I don't understand what it is trying to tell me." With very little effort or loss of space, certain of these abbreviations may be converted to natural language. For example, it takes only one extra character to turn a meaningless "NTE" into its English equivalent, "NOTE".

When a user is attempting a first search on the Information Bank there is enough novelty in the system and the procedures to occupy his mind. He must not be burdened with extra effort to decipher unfamiliar abbreviations.

2. Although the "B" and "D" options seem to allow the user to go to the next step, what actually happens is that he is taken back to the previous step. For example, the user may be viewing terms on a term selection screen; he asks to view the cross-reference to one of the terms; he then proceeds to the "next step" from the cross-reference screen and finds himself back at the original term selection screen he had viewed earlier. This is a very helpful and essential feature, but rather confusing to the new user. Perhaps revising the wording of the "A" and "D" commands can alleviate the problem for the novice.

J. Modification Stage: First Step

If you wish to restrict inquiry by other search elements:
A. View term modifiers (byline, sketch, weight), ENTER: A
B. View other modifiers (date, source, etc.), ENTER: B
C. View both term and other modifiers, ENTER: C
D. No restrictions--go to next step, ENTER: D

An obvious question at this step is what are "other" modifiers? In the abbreviated forms of system messages the same option is referred to as "bibliographic modifiers". A simple suggestion would be to replace the term "other" with "bibliographic" in the full forms of system messages.

Extending the function of the universal "W" key throughout the modification stage can be of great help in explaining the meaning of various modifiers.

The "D" option can also benefit from a slight modification. Following the established pattern of system messages, this option may be revised to read:
D. No restrictions (save prior entry). Go to next step, ENTER: D
This would save the novice user the extra steps involved in re-entering a modification he may have established during an earlier portion of his search. At present the system does not inform the user in any way that all modifications entered during a search remain intact even when new terms are added to the search.

From the academic user's point of view the "B" option is used much more heavily than "A". If the majority of the system's users confirm this preference it may be more efficient to switch the "A" and "B" options at this stage.

K. Modification Stage: Term Modification

Term modifiers are denoted by abbrevs as follows:
byline=ABT (about) or BYL (by)
sketch=BRF (brief) or DTL (detailed)
term weight (least to greatest)=1, 2, 3 or 4

A. Apply abbrev to 1 or more search terms
ENTER: A//term number <abbrev//term number <abbrev//. . .etc.
B. View continuation, ENTER: B
C. Go to the next step, ENTER: C

As mentioned in the previous section, this option does not receive much use in this academic environment. However, the basic misunderstandings which occur are related to definition of terms rather than following the instructions.

To an academic user a "sketch" may mean an "outline" or a "drawing". No one related this term to biographies. It would certainly be to the advantage of the non-journalist user to get a better understanding of this term on-line, preferably through an expansion of the instructional message. The same procedure may also be used to define "about line" and "term weight" to the uninitiated user.

L. Modification Stage: Other Modifiers

Select other means to modify search from this list

1. date	*4. type of material*	*7. section*
2. journal	*5. illustrations*	*8. page*
3. source	*6. abstract weight*	*9. column*

A. Select 1 or more modifiers
ENTER: A//item number//item number//. . .etc.
B. Skip this, go to next step, ENTER: B

Although the instructional message is very simple to follow, the problem of definition of terms also applies to this step in the modification process.

"Source" is not easily interpreted as "press agency" by this non-journalist user group. In fact, most users interpret "source" from a library standpoint, thus equating it with the name of the journals.

"Type of material" has no meaning to the novice user, but with the exception of "date", it is the most often used option once the meaning has been made clear to the user. At the modification stage there is no screen display beyond the instructional messages. It would seem reasonable to expand some portions of the message to provide clarification of individual terms used.

M. Modification Stage: Date Modification

Date is year-month-day Example 1971-12-31
A. Limit material to 1 date of publication, ENTER: A//date
B. Limit to up to 8 alternate dates, ENTER: B//date//date//etc.
C. Limit to 1 date range, ENTER: C//date TO date
D. Limit to up to 8 ranges, ENTER: D//date TO date//. . .//etc.
E. Limit to dates/ranges, ENTER: E//date//. . .//date TO date//etc.
F. Skip this (or cancel prior entry); go to next step, ENTER: F
G. Save prior entry if any; go to next step, ENTER: G

This is by far the most popular mode of modification in this academic community. The instructions are very simple and easy to understand. Only one comment need be made here. The date example offered on-line misleads the user into thinking that he must always include year, month, and day in his request. Thus, when he wishes to limit his query to a given year, say 1973, he chooses the "C" option and responds as follows:

C//1-1-1973 to 12-31-1973

instead of the much simpler option available to him:

A//1973

Perhaps the date example can be expanded to include this time-saving hint.

In Section I of this chapter it was suggested that the user be given the opportunity to check his last response. This is one of the stages where many users wish to confirm a modification they have just entered; perhaps to double check on its accuracy. Although "term modifiers" visibly tag the affected term at the logic stage, no indication of bibliographic modification is present until the user begins to view abstracts. It would be helpful to have an early indication of those modifiers accepted by the system.

N. Logic

A. Link terms with logical connectives and view remaining terms.
ENTER: A//term number and (or, not) term number and. . .etc.
B. Link terms with logical connectives and begin search.
ENTER: B//term number and (or, not) term number and. . .etc.
C. View continuation, ENTER: C

Here, as with many of the previous steps discussed, the novice user chooses the "A" rather than the "B" option not because it is applicable to his search, but rather because it was the first instructional message on the screen. The majority of searches in the academic community are carried out without using the paging option available. Again, if this proves to be the case with other user groups as well, it may be worthwhile to consider placing the most-used option at the top of the screen.

It is also noteworthy that the present instructions imply that a linking of terms is necessary in every case. A user who may have picked three terms, one with only a single citation, may wish to view that abstract alone. The instructions do not guide him as to how he may proceed with such a request.

Because of an infinite variety of errors possible at this stage, many of the present error messages tend to mislead the user. The following is a case in point. A user had selected the terms "Confucious" and "cultural revolution." At the logic stage he typed the following message:

b//confucious and cultural revolution

The system responded with the following error message:

"an OR AND or NOT did not follow a # or right paren"

if the user had been conceptually aware of the procedure for linking terms, he may have been able to decipher the error message, but in this case the error analysis provided no relief.

Other cases of errors involve the concept of "Boolean operators". It is suggested that either Boolean errors be diagnosed in more detail to offer relevant error messages, or to simply revert to the system's standard error messages, and allow the user to re-evaluate his own response. Again, it would be helpful to the user if he could see his last response at the time he received the error message. In any event, a helpful addition to this stage would be to offer the user, upon demand or after two consecutive failures to formulate correct logical connectives, some simple hints or lessons on Boolean logic.

For those users who choose the "A" option from the logic stage, the system responds with this message:

A. Replace logic and view continuation.
ENTER: A//term number and (or, not) term number and . . .etc.
B. Replace logic and begin search.
ENTER: B//term number and (or, not) term number and . . .etc.
View continuation, ENTER: C
D. Add to logic and view continuation.
ENTER: D//term number and (or, not) term number and . . .etc.
E. Add to logic and begin search.
Enter: E//term number and (or, not) term number and . . .etc.
F. Logic complete. begin search, ENTER: F

Most novice users do not attempt searches which require paging. Thus, the difficulties in performing a search of this type will not be discussed in this report. However, two points must be made here. First, the "C" option to "view continuation" is missing from the screen. John Rothman has pointed out that this was due to an oversight and will be corrected.

Another item which is exclusive to this screen is that the user's response is carried over from the previous page. Thus we are assured that the capability of providing such information is within the present bounds of the system. As suggested before, it would be helpful to expand this provision to other steps of the search.

III. An Overview

One of the outcomes of the Stanford workshop of on-line systems designers was the consensus reached on a number of features deemed to be "essential" for interactive searching. These minimal features are as follows:

1. User's guide; preferably complete and usable
2. Live help; by telephone or message-command
3. Suffix removal
4. Search field control
5. Relational operators for numeric data bases
6. Boolean operators
7. Request sets; building the logic upon previous sets
8. Search review; allowing the user to retrace his steps
9. Pre-defined formats; including fields, short citations or full documents
10. On-line formatting; for the user with special needs
11. Off-line printing (10)

Of these eleven features, only four are fully available in The New York Times Information Bank. These are the user guides, live help, suffix removal by truncation, and Boolean logic operators.

The relational operators are not necessary for this particular data base. Ample provisions are made for all numeric fields (such as date, page and section numbers) used in the data base.

Independent search field controls are not available. All searching must initiate through the use of index terms. That is, one cannot ask for the front page news of a particular day, or all the by-lines of a given week; nor can a search be conducted by titles of articles, or through a specified set of abstracts. Although none of these options may appear useful to the newspaper community, some can be of great help to those in an academic environment.

Request sets and search review options would also be of assistance to the user who must currently rely upon his memory to re-construct the previous segments of his search. It would be especially useful at the logic stage to be able to review previous logical connectives made and their respective search results.

Pre-defined formats and on-line formatting options have been suggested as useful additions to the system by many users. It is considered as one of the major shortcomings of the present system that only a single, pre-defined, format for output is available. The user must view both citation and abstract for each item. The simplest option most frequently requested by users is a "citation only" output. Those users who fully intend to refer to the full text of articles retrieved consider it a waste of time and money to obtain prints of abstracts when the citation alone meets their needs.

Off-line printing is also not currently available to subscribers. This is a great limitation to those doing extended research on large files. The only option at present is to print citations and abstracts one page at a time. As this time-consuming procedure also ties up the terminal for the duration of the printing process, the cost for prolonged printing becomes prohibitive.

An even more obvious waste which could be eliminated is the repeated printing of instructional messages which appear at the top of each screen. It seems that the CRT program could be modified to block the hard-copy printing of the messages at this stage.

It has not been the intention of this author to burden a single system with all features deemed useful or necessary by various designers or user groups. On the contrary, there are many additional features not mentioned in this report, but currently available in other systems which could be adapted by The New York Times Information Bank to the benefit of all its users. A single relevant example will be cited. When a user arrives with a clipping of an article—or finds a single article on-line—he may comment that he needs other articles on the same topic. It would be extremely helpful if the Information Bank provided the index terms attached to a given abstract. Other examples abound, but the author has specifically avoided discussion of features which seem to fall outside the objectives or scope of services provided by the Information Bank. It is hoped that the analysis offered will be accepted on that basis and open the way to future changes which would reflect the needs of all non-specialist users of the system.

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(2) John Rothman. "The Times Information Bank on campus." EDUCOM. 8 (Fall 1973) 16.

(3) John Rothman. Letter to the author. 25 February 1974.

(4) Thomas Martin. A feature analysis of interactive retrieval systems. p. 18.

(5) John Rothman. "The Times Information Bank on campus." p. 16.

(6) Thomas Martin. A feature analysis of interactive retrieval systems. p. 75.

(7) Thomas Martin. A feature analysis of interactive retrieval systems. p. 76.

(8) Davis McCarn. Conversation with the author. 8 September 1974.

(9) Many authors in the fields of education and psychology, as well as those involved in the training of users for on-line systems have expressed this fact. The following is offered as a sample of this cross-section: D. H. Holding. Principles of training. Oxford: Pergamon Press, 1965. p. 81. Richard S. Marcus, Alan R. Benenfeld, and Peter Kugel. "The user interface for the INTREX retrieval system," Interactive bibliographic search: the user/computer interface. Edited by Donald E. Walker. Montvale, N.J.: AFIPS Press, 1971. p. 191.

(10) Thomas Martin. A feature analysis of interactive retrieval systems. pp. 86-100.

CHAPTER IX

SUMMARY AND CONCLUSIONS

This study was undertaken to test the effectiveness of a computer-assisted tutorial program in teaching the novice user the procedures for conducting a search on The New York Times Information Bank. It was also hoped that in the course of the experiment the learning process of the novice user would be traced to isolate the thesaural from mechanical problems. As a very important by-product, the process of this study was to yield a detailed analysis of search failures due to misinterpretation of on-line instructional and error messages.

The quantitative as well as the qualitative analysis of data offered in chapters 5 and 6 clearly support the first hypothesis related to the effectiveness of the tutorial program. However, because of the developments in the course of the experiment which revealed that the tutorial group did not refer to the printed instructions offered as a part of the system, this hypothesis may be amended and accepted as follows:

The computer-assisted tutorial program for The New York Times Information Bank is a more effective tool than the printed instructions offered by the system for learning to use the Information Bank.

What is also clearly shown by the data is that the tutorial program, though more effective than the printed instructions, is far from being a fully effective training medium.

Some of the shortcomings of this particular CAI program were detailed in chapter 7, but it would also be wise to consider the inherent shortcomings of this or any other single medium. The Intrex project showed that a combination of several training methods worked better than any single mode used alone. It also brought to light the fact that even with such combination all users could not be satisfied at all times. (1) The Stanford Workshop revealed that a majority of on-line system designers feel that a combination of live help and printed instructions are essential ingredients of an interactive bibliographic retrieval system. (2) On the other hand, although we find that all present systems offer some form of printed instructions as well as live help, this combination has also failed to provide the desired results.

Davis McCarn of the National Library of Medicine, in a study conducted in March, 1973, encountered the following reasons for the failure of live training of the medical community to use MEDLINE.

1. The staff's lack of ease in dealing with the novice user.
2. Inexperience in teaching.
3. Preservation of the status symbol for the instructor (who may feel that he may no longer be of service if the ultimate user becomes fully proficient in handling the system.)
4. The instructor's low estimate of patron capability.
5. The instructor's personal interpretation of the "proper" use of the system.
6. The National Library of Medicine's establishment of a fee schedule based upon connect time which discourages unrestricted use of the system. (3)

We will find that the last item applies to all commercial and profit making systems as well. The New York Times allows two months of unrestricted use, but depending on the individual contract, connect time changes apply after

the second month. The remaining five causes, however, are all related to the biases of live help. Thus, although it remains the author's strong belief that live help is presently essential for acquainting novice users with an on-line system, it is deemed just as essential to provide the user with alternative means of obtaining the desired information. An on-line tutorial program, built as an integral part of the information retrieval system is seen as the ideal alternative or back-up to live help.

The second hypothesis of this study sought to separate the learning process at the terminal into its "mechanical" and "thesaural" elements. The qualitative results of the experiment reveal a refinement of this hypothesis. It was shown that in the order of most to least importance, the user may encounter one or more of the following problems: conceptual, interpretational, thesaural, and mechanical. Such problems could be easily isolated in some cases, but usually proved to work in a chain reaction. The highest degree of failures could be ultimately attributed to the conceptual misinterpretation of the function of the system in general, or the flow of steps making up the search process in particular. This was followed closely by problems related to the interpretation of instructional or error messages appearing on-line.

The present study did not reveal any significant difference in results between the sections receiving assistance in term selection and those left to conduct their own term negotiation. Unfortunately, the small sample size in Section II (24 participants) does not permit the author to either confirm or deny thesaural problems as a major cause for search failures. However, a more detailed look at individual "term selection" processes revealed that many misunderstandings resulted from the physical layout of the term selection screen and the abbreviations used on-line in connection with thesaural displays.

Mechanical problems faced by the participants did not lead directly to search failure. They were usually an indication of another, more important, problem which the user was facing at the time. However, many pure mechanical problems--such as using the lower case letter "ℓ" for the numeral "1" and other typographical errors--are analyzed incorrectly by the system, thus misleading the user. Being unaware of the actual cause of error, the user may fail to complete a search due to mis-interpretation of instructional messages. Chapter 8 of this study has dealt in detail with problems related to the instructional messages appearing on-line.

The second hypothesis may thus be accepted with the following refinements:

The learning process at the terminal is divided into three separable areas: The concept of formulating a search strategy, mastering the use of the on-line thesaurus of the Information Bank, and correctly interpreting the on-line instructional messages.

In looking back at the questions posed prior to the conduct of the study (chapter 3), we find that this experiment has provided some insight into the novice user's learning process. It has shown some of the advantages of the CAI program over printed instructions; and proved that familiarity with the mere mechanics of formulating a search strategy does not guarantee a successful search. Although we have in fact seen that certain individuals do not respond to printed or computer-assisted instructions, no attempt was made to find a suitable medium for all users of the system, or to prove that certain individuals may be characteristically incapable of using an on-line information retrieval system with complete ease and success.

Recommendations for Future Study

1. Because of this study's failure to delve deeper into the problems related to the on-line thesaurus of The New York Times Information Bank, it

is suggested that a follow-up study concentrate on this aspect of the novice user's search problems.

A tutorial program dealing with the problems of term selection and entry has been developed for this purpose. It may be useful to test its effectiveness in a similarly designed experiment.

2. It would be of interest to compare the results obtained from the present study with a control group receiving live instructions of similar duration. As an extension of the comparison of various training media, it would also be worthwhile to test the effectiveness of a slide-show produced by the Campus-Based Information System (using the same sample question as the CAI program). Since the instructional content of all sessions can be kept constant, such a study may provide a particular direction to future efforts expended in the area of user training.

3. The present study was conducted in an academic environment. If the results obtained in this setting correspond with those obtained from other segments of the user population, it would certainly add strength to the recommendations for modifying some of the on-line instructional messages. On the other hand, if it were found that such results are unique to the academic community, it would be an indication to The New York Times that their system is more suited to a particular segment of the universe of users. Such indication may lead to a re-direction of marketing efforts on the one hand, or design efforts on the other, to adapt the system to its ultimate user group. It is thus strongly urged that similar studies be conducted with other segments of the user population.

4. It is essential that the students and designers of on-line, interactive bibliographic retrieval systems look upon the human side of man/machine

interaction as one of the major ingredients of such a system. Thomas Martin's comments on this topic may be considered the basis for the broadest spectrum of research which needs to be done in this area:

> The manner in which a person interacts with a computerized system and the manner in which he carries out his searching task are not isolable phenomena. They are instances of behavior and can best be understood in a broader communication and/or problem-solving context. One can only discover what is unique about man-computer communication and interactive searching by contrasting each with its respective behavioral background. While principles can be derived from experience, there is a need to relate the principles to similar phenomena and to carry out tests that measure the reliability of the principles. (4)

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